THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

VOL. 53 Thursday, October 24, 1935 No. 1001

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial: 17s. 6d. per annum.
All Subscriptions are payable in advance.

All Communications to be addressed to the Editor, the Advertisement Manager, or the Publisher of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2

Telegraphic Address: "Zacatecas, Rand, London."
Telephone: Temple Bar 3951 (6 lines).

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF

The Institute of British Foundrymen
The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

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Foundry Catalogues

Perhaps the issue of our thousandth number has diverted our mind to a reminiscent channel. At any rate, we have been wondering when the first purely foundry catalogue was issued. Naturally one must exclude literature dealing with castings as finished articles of commerce, such as hinges and rain-water goods, for by foundry catalogues we mean a booklet which stresses the ability of an establishment to make castings. Pictures of castings are included merely as examples, and are not to be sold from stock. Of the five thousand or so foundries and foundry departments in the United Kingdom only a handful have deemed it wise to issue catalogues, due no doubt to the difficulty of knowing what to say and of being satisfied that amongst the matter there is something which will induce people to send along inquiries.

Yet the average foundry does possess material upon which a good catalogue can be built up. Amongst the points that can be emphasised are the following, if mention be warranted:—Location; choice of raw materials; specially good melting facilities; moulding processes, conditions or accumulated experience; commercial and technical service; special alloys or mixtures; surface; machinability; finishing, mechanical strength and fettling facilities; conditions for rapid delivery, and machine-shop equipment, to detail but a few.

A number of foundries apparently try to "blind the buyer with science" by the inclusion of micrographs. These are not so useful as macrographs which give a bird's-eye view of the cleanliness of the structure of the casting. An American foundry which favours us with its publicity matter has thought it wise to include a list of instructions to its clients as to how their patterns should be marked. This is quite a good feature as it directs the recipient's mind to the actual business of buying. A West Country foundry issues an invitation for a personal inspection of their plant and details the rail and road facilities and the hotel accommodation available locally—a feature which naturally tends to eradicate any preconceived notion of difficulty of access. A mistake which some foundries make is to stress their ability to make difficult and complicated castings, yet whilst these may resemble works of art, and must obviously be made by somebody, a plethora of this type of work is more likely to reflect on the debit rather than the credit side of a balance sheet. Such castings are very useful for mixing and for maintaining a high standard of craftsmanship within the organisation. Finally, we wish to congratulate the section of the industry making alloyed and high-duty cast iron on the efforts recently made by their officers responsible for publicity. One section is making a mistake by retaining American standards for the expression of tensile tests and the like.

Progress in the Heavy Industries

The speech of the chairman of United Steel Companies, Limited, on the occasion of their annual meeting, included some interesting illustrations of the revival of the steel industry following the depression of 1930-32.

The figures quoted showed several striking features. In all the steel-producing countries production had expanded since 1932. Secondly, the lead in this recovery had been taken and kept by Great Britain, an interesting reflection on the view once widely held that recovery from depression must begin in America. In the third place, Great Britain had now reached the output level of 1929, the year which steelmakers had begun to look back upon as an enviable one from the point of view of output. On the other hand, Western Europe, including France, Belgium, Germany and Luxemburg, had only advanced about 75 per cent. of the way towards this goal, while the United States was even further behind. The output in Great Britain for the first half of 1935 would, if maintained for the year, equal the 1929 production, and the home production would be nearly a million and a-half tons more than would have been the case if imports of steel had not been reduced by the tariff. The home consumption of steel had risen above 1929, and exports were materially higher than in 1932.

Some interesting facts were also indicated. If steel rails on railway tracks all over the world were placed together side by side they would go all round the world in a solid road of steel over 15 ft. wide, and locomotives and rolling stock placed buffer to buffer would more than cover its whole length. There are 30,000 tons of steel in the largest ship, which has a displacement of 68,500 tons. There is less than a ton of steel in the average motor car, for which the maker gets about a third of what the garage man is said to get for selling it to the user. In 1910-13 the steel trade used about 30 per cent. of scrap. In 1934 this had grown to over 50 per cent., and hence steel production expands more than pig-iron production.

The general trend of the improvement shown is reflected in official figures for trade as a whole, and optimism is only restrained by the possibility of international difficulties, by trading restrictions and by the still large number of unemployed.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents]

Modulus of Elasticity

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Referring to the report in your issue of October 3, dealing with the writer's reply to the discussion on "Relationship in Cast-Iron Test Results," the sentences regarding the machining of tensile bars should read :—

"It is necessary when taking tensile tests from parallel bars, to machine the middle to ensure breaking away from the grips. In America, 1.2-in. dia. tensile bars with wide ends have been used, but as Mr. Shaw has pointed out, the wide ends anneal the bar and lower the results so that more was lost than gained."

During the discussion, a request was made for the definition of modulus of rupture, but time did not permit a reply in detail. The following has since been written in an endeavour to explain how it is calculated, and also how calculations for the correction of the breaking loads of incorrect sizes of bars are made.

Effect of Span, Breadth, Depth and Diameter

The breaking load of a transverse bar varies inversely as the span. Thus a bar doubled in span will break at half the load, or if the span be halved the load will be doubled. Therefore, for the same section and strength, load times span will be constant. This calculation is only required, as a rule, when modulus of rupture is required.

For a rectangular bar the breaking load varies as the breadth and as the square of the depth. Thus a bar 2 in. broad will break at twice the load of a bar 1 in. broad and a bar 2 in. deep will break at four times the load of a bar 1 in. deep, always providing the other dimensions and span remains the same.

Corrected load for error in breadth is :—

$$\frac{\text{Actual breaking load} \times \text{standard breadth}}{\text{actual breadth}}$$

Example.—A bar 1.1 in. broad instead of 1 in. broad breaks at 30 cwts.

$$\text{Corrected load is } \frac{30 \times 1}{1.1} = 27.3 \text{ cwts.}$$

Corrected load for error in depth is :—

$$\frac{\text{Actual breaking load} \times \text{standard depth}^2}{\text{actual depth}^2}$$

Example.—A bar 2.1 in. deep instead of 2 in. breaks at 30 cwts.

$$\text{Corrected load is } \frac{30 \times 2 \times 2}{2.1 \times 2.1} = 27.2 \text{ cwts.}$$

Corrected load for errors in breadth and depth is :—

$$\frac{\text{Actual breaking load} \times \text{standard breadth} \times \text{standard depth}^2}{\text{actual breadth} \times \text{actual depth}^2}$$

Example.—A bar 1.1 in. broad by 2.1 in. deep instead of 1 in. broad by 2 in. deep breaks at 30 cwts.

$$\text{Corrected load is :} \frac{30 \times 1 \times 2 \times 2}{1.1 \times 2.1 \times 2.1} = 24.7 \text{ cwts.}$$

For a round bar the breaking load varies as dia.^{3}; thus a 2-in. dia. bar would break at eight times the load of a 1-in. dia. bar ($2 \times 2 \times 2 = 8$ $1 \times 1 \times 1 = 1$) for the same span.

Corrected load for error in diameter is :—

$$\frac{\text{Actual breaking load} \times \text{standard dia.}^3}{\text{actual dia.}^3}$$

Example.—A bar 1.25 in. dia. instead of 1.2 in. dia. breaks at 2,500 lbs.

$$\text{Corrected load is : } \frac{2{,}500 \times 1.2 \times 1.2 \times 1.2}{1.25 \times 1.25 \times 1.25} = 2{,}210 \text{ lbs.}$$

Calculation of Transverse Modulus of Rupture

To show transverse results without having to give full details of bar dimensions or to compare the results from bars of different sizes and shapes, it is necessary to convert the transverse breaking load to transverse modulus of rupture.

This gives the transverse strength in tons (or lbs.) per sq. in. and is calculated by means of a formula which takes into consideration span, breadth and depth of rectangular bars, or span and diameter for round bars, on lines similar to those shown above. When the load is in tons and the dimensions in inches the result is in tons per sq. in., but if the load is in lbs. or cwts., it must be converted to tons or a factor introduced into the formula to equal the conversion.

Transverse modulus of rupture in tons per sq. in.

$$\frac{\text{Breaking load in tons} \times \text{span in inches}}{4 \times \text{modulus of section}}$$

The modulus of section for a rectangular bar is :—

$$\frac{\text{Breadth} \times \text{depth}^2}{6} \quad \therefore 2 \text{ in.} \times 1 \text{ in.} = \frac{4}{6} \text{ and } 1 \text{ in.} \times 1 \text{ in.} = 1/6.$$

Example 1.—A bar 2 in. × 1 in. × 36 in. (2 in. being the depth) breaks at 30 cwts. 30 cwts. = 1.5 tons, so the calculation is :—

$$\text{Modulus of rupture} = \frac{1.5 \times 36}{4 \times \frac{4}{6}} = \frac{1.5 \times 36 \times 36}{4 \times 4} = 20.25 \text{ tons per sq. in.}$$

Example 2.—A bar 1 in. × 1 in. × 12 in. breaks at 25 cwts. (1.25 tons).

$$\text{Modulus of rupture} = \frac{1.25 \times 12}{4 \times \frac{1}{6}} = \frac{1.25 \times 12 \times 6}{4} = 22.5 \text{ tons per sq. in.}$$

The modulus of section of a round bar is :—

$$\frac{\pi \text{ dia.}^3}{32} = 0.0928 \times \text{dia.}^3$$

Example 3.—A bar 1.2 in. dia. × 18 in. span breaks at 2,000 lbs. (0.893 ton).

$$\text{Modulus of rupture} = \frac{0.893 \times 18}{4 \times 0.0982} \times 1.2 \times 1.2 \times 1.2 = 23.6 \text{ tons per sq. in.}$$

The above shows complete calculations for three bars, but as in all standard bars the span and section for each bar are constant, the part of the formula dealing with them (including the conversion of lbs. or cwts. to tons) can be simplified to a single factor, so that all that is necessary to calculate transverse modulus of rupture is to multiply the breaking load by the factor appropriate to the bar tested. These are given below :—

1 in. × 1 in. × 12 in.-lbs. × 0.00803 = tons sq. in., or cwts. × 0.9 tons sq. in.
2 in. × 1 in. × 36 in.-lbs. × 0.00603 = tons sq. in., or cwts. × 0.675 = tons sq. in.
$\frac{7}{8}$ in. dia. × 12 in.-lbs. × 0.0204 = tons sq. in., or cwts. × 2.28 = tons sq. in.
1.2 in. dia. × 18 in.-lbs. × 0.0118 = tons sq. in., or cwts. × 1.32 = tons sq. in.
2.2 in. dia. × 18 in.-lbs. × 0.00192 = tons sq. in., or cwts. × 0.215.

It must be borne in mind that the factors only apply to breaking loads of bars of standard size (or after allowance has been made for incorrect size). The factors for the direct calculation of modulus of rupture from the breaking loads of round bars of incorrect size were given in Table II of the Paper.

All the calculations shown above are theoretical and may not be quite true in practice. The extent of the differences to be expected between rectangular and round bars; bars of different sizes and bars tested at various spans were also given in the Paper.

—Yours, etc.,

G. L. HARBACH,
Metallurgist.

Worthington-Simpson, Limited,
Newark-on-Trent.
October 15, 1935.

Cupola Melting Rate

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Regarding your editorial on "Cupola Melting Rate," I would suggest that the definition be made in reference to two main items, namely, (*a*) Air supplied per pound of coke, and (*b*) Ratio of coke to iron.

For standard conditions an air ratio should be agreed upon, a suitable figure being 165 cub. ft. per lb. of coke, which I have shown elsewhere to give the best results in most cupolas. This is about 15 per cent. excess over the theoretical required to burn the average foundry coke.

The use of some such agreed figure, coupled also with a fixed coke ratio, say, 10 per cent., would automatically reduce many of the variables.

The increased cross-sectional area at the melting zone during blowing and due to loss of lining will increase the capacity of the cupola, and more air will be required *pro rata* to the coke as melting proceeds, so that with a fully-charged cupola the greater burden passing through is catered for by increased air.

Actually, the increased capacity so produced is probably not so great as the increased area would suggest, since this only extends for a comparatively short distance around the melting zone.

The following table shows the increase in cross-sectional area for three sizes of cupola in operation up to eight hours, and assuming a loss of 1 in. of lining per hour on the diameter.

Cupola dia.	42 ins.		48 ins.		54 ins.	
	Sq. ins.	Per cent. inc.	Sq. ins.	Per cent. inc.	Sq. ins.	Per cent. inc.
Area as lined ..	1,385	—	1,809	—	2,290	—
After 2 hours ..	1,520	9.7	1,963	8.5	2,463	7.6
After 4 hours ..	1,662	20	2,124	17	2,642	15.4
After 6 hours ..	1,809	30	2,290	27	2,827	23
After 8 hours ..	1,963	42	2,463	36	3,019	32

The actual increase in volume in 8 hours as measured by the amount of refractory required to re-line to the original diameter will be between 5 and 10 per cent. of the total volume of the cupola to the charging door or burden top.

The definition should also preferably refer to a standard charge of, say, 60 per cent. pig-iron and 40 per cent. defined scrap, and using coke of an agreed hardness and analysis.—Yours, etc.,

S. E. DAWSON.

231, Derby Road,
Beeston, Notts.
October 15, 1935.

Foundry Workers Want "Cuts" Restored

If the 25,000 Lancashire and Yorkshire workers employed in the light-metal trade get the restoration of wage cuts imposed in 1928, for which they are fighting, it will mean that employers will have to pay £2,700 more in wages every week. Men employed in such centres as Rotherham, Leeds and Warrington have great hopes that their claim will be successful in view of the vastly-improved conditions in the industries during the past two or three years.

An application for the restoration of the cuts is being made by the Joint Committee of the Light Metal Trades Unions on behalf of eleven affiliated unions, including the Central Ironmoulders' Association, the National Union of Stove Grate Workers, and the General Iron Fitters' Union. In a statement to the Press, Mr. Adam Bennett, of Rotherham, secretary of the joint committee, said that last year the National Light Castings Ironfounders' Federation agreed to restore the cuts imposed in 1931. It was then understood that should the trade improvement be maintained the men would be entitled this year to apply for the restoration of the cuts.

The New Foundry of Messrs. Winget, Limited

A MECHANISED PLANT AT ROCHESTER

By VINCENT C. FAULKNER

The firm of Winget was established for the object of manufacturing concrete mixers and similar public works' plant at Warwick in 1901, and became a limited company in 1906. In the spring of 1934 the firm removed to Rochester in Kent, as the existing manufacturing facilities were too small and the old works of Aveling & Porter presented a site which showed several advantages, such as the proximity to the River Medway, excellent railway facilities and a reserve of skilled operatives. The works now employ about 520 men; the foundry is extensively mechanised and makes nothing other than Meehanite—a high-duty cast iron—which is made under controlled conditions, and enters into the "modified iron" classification. The size and lay-out of the new foundry is shown in Fig. 1.

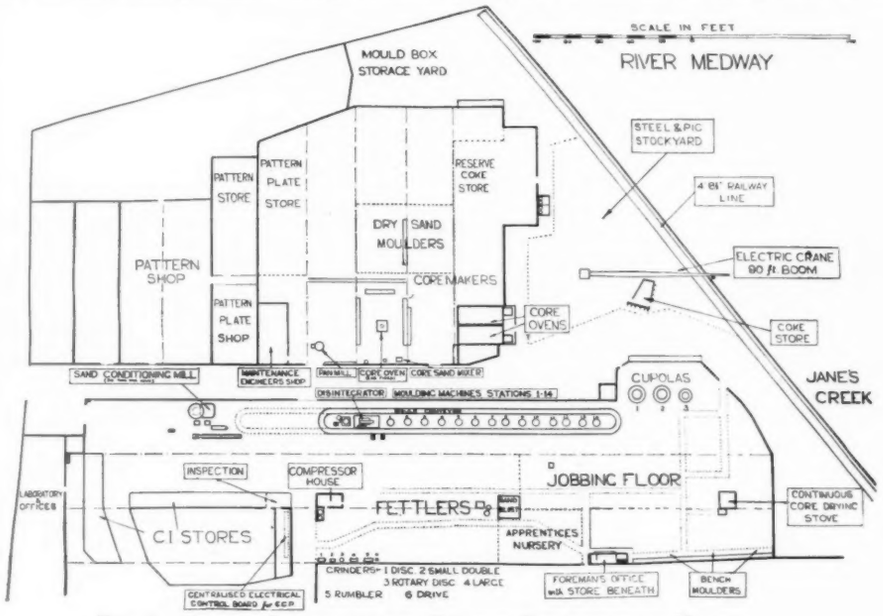

Fig. 1.—General Lay-out of the Foundry Department of Messrs. Winget, Limited.

Raw Materials

The raw materials for the cupola are handled by an electric crane having a 90-ft. boom, which enables it, by means of an over-balanced skip, to empty direct into the bins installed upon the foundry stage. The skip is swung round on the boom until it comes in contact with the rail at the top of the bin, when automatic discharge is effected. These bins are built against the wall opposite to the actual cupolas, and by inclining their backs outwards they can be filled without the skips actually entering within the area of the cupola platform. There is ample room for coke storage, both outside and under cover.

Fig. 2.—Cupola Stage capable of carrying 150 tons of Stock.

Melting Plant

There are three cupolas, two of which are to the designs of Mr. Oliver Smalley, and all made by the Constructional Engineering Company. Two are at the moment lined down from 3 ft. 6 in. to 36 in., whilst the third (No. 1 actually) is still further reduced to 27 in. It is used for jobbing work. These cupolas are characterised by a deep wind belt and a shallow bath, and carry eight tuyeres delivering the blast tangentially. Numbers 2 and 3 are blown by a 20-h.p. electrically-driven Keith Blackman fan, whilst No. 1 is furnished with an 8 h.p. A view of the charging stage, capable of carrying 150 tons of stock, is shown in Fig. 2, from which it will be seen that a spring balance is used for weighing all charges, whilst the time-honoured system of chalking the number of charges on the cupola ironwork is still practised.

The floor beneath the cupola is sloping, so that the water used for quenching the dump is properly drained. There are burners for heating up the ladles and shanks, and in the near future a mono-rail system will be installed for handling the liquid metal. At the moment the hand shanking is carried out as shown in Fig. 3.

Fig. 3.—The Cupolas carry a specially deep Wind Belt. A Monorail is shortly to replace Hand Shanking.

The Mechanised Foundry

The area occupied by the mechanised continuous-casting plant is about 390 ft. by 30 ft. The Winget, Limited, Foundry commenced operations on May 15 of last year, when the output for that month and June totalled 36½ tons. In May this year it reached 165 tons. An analysis of this production shows that of the material charged there are produced 60.71 per cent. of

Fig. 4.—The Knock-out is of the Jar Type.

good castings; 30.95 per cent. of gates and risers; 3.47 per cent. of foundry wastes; and 4.87 per cent. of melting loss. The actual continuous-casting plant was manufactured in their own shops to the designs of Foundry Equipment, Limited, and the making of the foundations involved the excavation of some 3,000 tons of material, which included a steam-hammer base, three bases for compressors, the cellars of three cottages and two piers from an old stone bridge which used to cross the Medway at this point some 50 years ago.

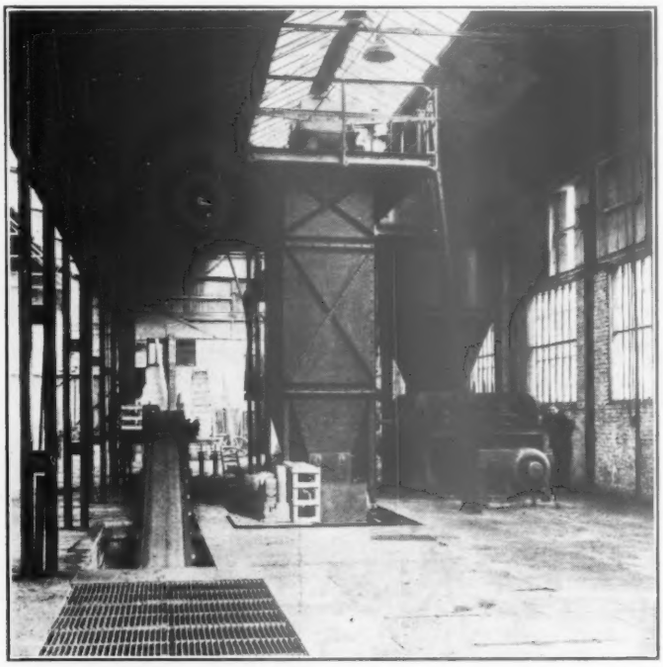

Fig. 5.—The Sand-reconditioning Plant, with the Mill on the Right-Hand Side.

Sand Preparation

Obviously, the main source of the sand is from the knock-out, shown in Fig. 4, and a grating, carrying two compartments, shown in Fig. 6. These belts in general are 36 in. wide for the feeder belts and 24 in. for the distribution ones. After passing over the magnetic separator, the sand falls into the boot of a hopper feeding an elevator shown in Fig. 6, and is discharged into a rotary screen, where all hard cores and extraneous matter are eliminated. This screen is hexagonal and is 5 ft. in dia. by 9 ft. long, carrying a 1-in. mesh made from ¼-in. wire. After screening, the sand falls into a 22-ton capacity hopper, shown at the right of Fig. 5 and the left of Fig. 6. At its base is a delivery plate, which rotates at 3 r.p.m., and a scraper deflects the stream into a standard 12 ft. dia. Baillot sand mixer shown in Fig. 7. This long belt carries the sand underground beneath the grating, shown in Fig. 5; at this point it spills over the end of the inclined belt (which terminates in a magnetic separator for removing all tramp iron) on to a belt which receives from a second belt the necessary supply of new sand and coal dust, which is fed in through the view shows the entry of the sand, the smooth and corrugated rollers, the scrapers for deflecting the sand irregularly and the adjusting handles. The sand works from the outside gradually to the centre—where it falls through a hole to a short length of conveyor, and by means of a bucket elevator fills a 40-ton capacity storage bin.

Fig. 6.—New Sand and Coal Dust is introduced through the Grating shown at the Left-Hand Side.

Fig. 7.—The Baillot Sand Mixer.

At the base of this bin, which is furnished with an adjustable sliding gate, is a further short length of feeder conveyor feeding a main-belt conveyor, running underground to a position within the mould conveyor shown in Fig. 8—a distance of some 30 yds. Here the sand is spilt into the boot of a hopper, feeding a bucket elevator, where it is disintegrated by passing at high speed through a squirrel-cage type of machine. The aerated sand falls on to a belt situated immediately above the moulding stations, where it is ploughed off according to requirements, the necessary adjustments being made by a boy. This portion of the plant is shown in Fig. 9. Any sand not taken by the plant spills into a shute at the cupola end of the shop into the main-return sand belt. This belt passes underneath the knock-out at the side of the mould conveyor.

The sand spilt from the moulding machines falls through a grating on to a belt running beneath the grating. At its end it discharges on to a short length of conveyor running at right-angles for feeding the main belt from the knock-out.

The sand is of the general-purpose variety and is used for both facing and backing. It is controlled to give an A.F.A. permeability figure of about 33, and a breaking load of 16 lbs., whilst the moisture content is 4.5 per cent. The variations registered in a full day's working were: permeability 31 to 36, bond 14 to 18 lbs., and moisture 3½ to 5 per cent.

Mould Conveyor

This consists of eighty cast-iron plates 3 ft. 3 in. wide by 4 ft. 6 in. long, carried on six wheels each fitted with roller bearings. Four of these wheels are under each plate and run on the main rails, whilst two others guide roller bearings run inside a suitable track approximately under the centre of the plates. The centres of the mould conveyor are separated by a distance of 153 ft. It can operate at speeds ranging between 7 and 21 ft. per min., the speed being regulated by Croft variable-speed gear driven by a 7-h.p. motor. When fully loaded with moulds, however, the conveyor takes but 2½ h.p. to drive it. It will be noticed from Fig. 1 that provision has been made for an extension of the conveyor, so that if the cooling time be insufficient—at present it is 10 to 32 min., according to the speed used—then additional time could be given.

Moulding Plant

Stations are provided for 14 machines or more by attaching breeches to the hoppers for supplying sand to a pair of machines working together.

Actually, eight have been installed, two of which are Nicholls squeeze-jolt type, four are F.E.2 of Foundry Equipment Company's manufacture. These are hydraulically-operated squeezers working at 750 lbs. per sq. in. pressure from an accumulator. Of the two others, both by Foundry Equipment, Limited, one is a jolt-squeeze roll-over and the other is a squeeze-and-draw machine. These two machines take a 21¼ inside dia. box, and the operation of the roll-over machine is shown in Figs. 11 and 12. Some of the machines are shown in Fig. 10. Concrete-tile pallet plates to the number of several hundreds of thousands have been made on this plant. All types of pattern plates are used, including cast-iron and composite ones made from white metal with a cement backing.

Fig. 8.—The Second Section of the Sand Plant enclosed within the Mould Conveyor.

Electric Operating Equipment

For its functioning, the plant incorporates 19 motors of a total horse-power of 130.5. The equipment control is centralised, and a view of the plant is shown in Fig. 13. A main circuit-breaker equipped with meters for light and power is fitted with independent starters, which are numbered and placed in the correct sequence so that each operation in starting up the plant is properly co-ordinated. The order of starting up the plant is (1) the overhead belt feeding the moulding machines; (2) the disintegrator and its elevator; (3) the belt from the storage hopper underground to the disintegrator elevator; (4) elevator from the pan mill to the storage hopper and the belt over this hopper; (5) the belt beneath the storage hopper; (6) the rotary screen; (7) the elevator feeding the screen; (8) the belt leading to this elevator; (9) the magnetic pulley and its feeding belt; (10) the belt taking the discharge from the spill conveyor to the knock-out conveyor; (11) the spill conveyor; (12) the knock-out conveyor; (13) the knock-out; (14) the sand mill; (15) the rotary disc feeding the mill from the hopper base; (16) the belt underneath the storage hopper; (17) the mould conveyor, and (18) the new sand and coal-dust belt.

Fig. 9.—The Sand-distributing Belt, showing Ploughs for Feeding the Mould Hoppers.

Conveniently situated above the plant itself are three push-buttons for shutting down the whole plant should any untoward happening occur. It is apposite to state here that the plant is particularly well lit both as to general and local illumination.

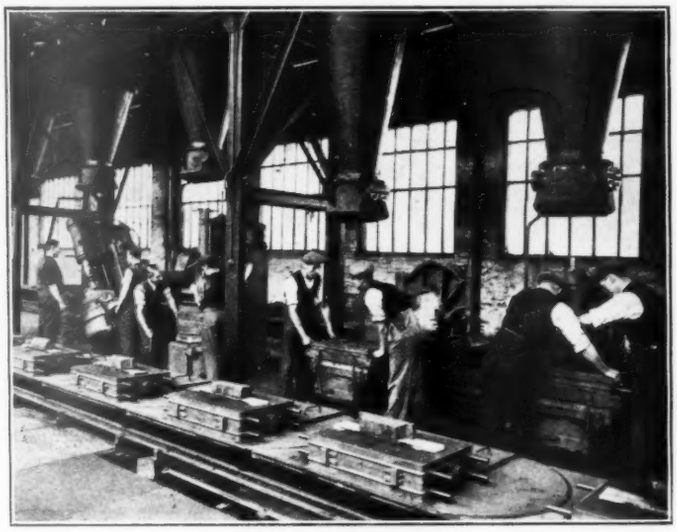

Fig. 10.—Showing some of the Moulding Machines and the Mould Conveyor.

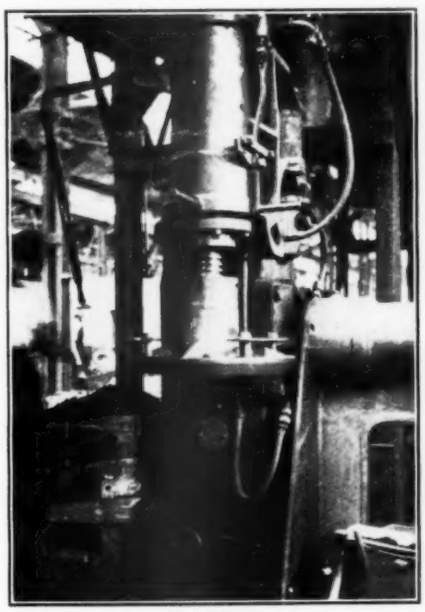

Fig. 11.—Roll-over Machine, showing Box just filled.

The Jobbing Floor

Provision has been made for supplying the jobbing floor with prepared sand by means of a short length of conveyor leading from the sand shute next to the cupola end of the plant, and where possible moulds will be placed on the mould conveyor for casting. Before the inception of the continuous-casting plant, a survey of handling revealed that 37½ tons of metal,

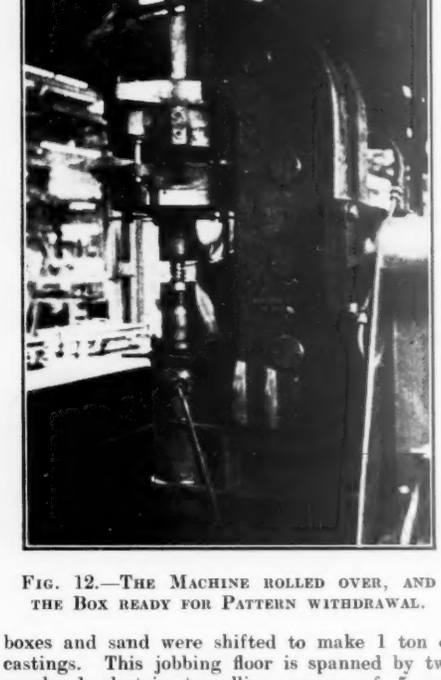

Fig. 12.—The Machine rolled over, and the Box ready for Pattern withdrawal.

boxes and sand were shifted to make 1 ton of castings. This jobbing floor is spanned by two overhead electric travelling cranes of 5 and 2½ tons capacity. It is a well-organised department and utilises a night shift for knocking out the castings, stacking boxes and making everything ship-shape for the next day's work. Preparations are in hand for the removal of this department over the roadway to the shops now used as a core department, and a continuous-drying stove by Bagshawe & Company has been erected in the position shown in Fig. 1. As a measure of prudence, which is worthy of emulation by all foundry owners, a nursery has been organised and 24 lads are being trained under the supervision of skilled workers. A view of this department is shown in Fig. 14.

Coreshop

The present coreshop is situated across a works road in the old foundry, and its removal to what is now the jobbing floor will obviously eliminate much handling. Herein also the dry-sand castings are made because of the existence of two large drying stoves left over from the Aveling occupation. These have to be transported across the way for casting up—an obviously unsatisfactory state of affairs. One of these drying stoves, which measures 9 ft. by 9 ft. by 20 ft. long, has been modernised and made much more efficient by installing an Acme stove (Foundry & Engineering Company, West Bromwich). These stoves are supplemented by a home-made town's gas-fired oven, using compressed air at 10-lb. pressure for aiding combustion. The stove may be opened at each end, and a small bogie running on light-gauge rails can be inside the stove, whilst a second is being loaded. A Winget pan mill is used for mixing oil and sand for coremaking, and a second one of the puddle type, by Foundry Equipment, Limited, is also in use. A pneumatic jolting machine is installed to aid production.

Fettling and Inspection

The lay-out of the cleaning department is provisional, and later means for connecting this section with the knock-out by conveyor will be installed. There is a Tilghman sand-blast cabinet, 8 ft. cube, and an electrically-driven line shaft operates a rumbler, a Roberts disc double-ended grinder, two double-ended grinders, one with 24-in. by 3-in. wheels and the other with 14-in. by 2-in. wheels, a 30-in. Jackman surface grinder and a Jackman No. 33 grinder for parallel grinding. The manufacture of pallets has strongly influenced the lay-out and choice of plant, and, as will be seen from Fig. 15, special jigs and gauges are used to ensure that every casting is true to shape. Some are ground to tolerances of $\frac{1}{10000}$ in. Broom-Wade compressors, pneumatic chisels and hand grinders are standard in this shop.

The pattern shop is well equipped for making any type or class of pattern demanded, as it covers both wood and metal. There are all the usual tools, such as band and circular saws, sanders, lathes, drilling machines and an electrically-heated glue pot. In the metal pattern-shop there is a town's gas-fired Selas furnace for melting white metal.

The use of this apparatus enables easy comparison to be made with the results obtained by Meehanite licensees in other parts of the world. The chemical laboratory is adequately equipped for all the normal tests required in foundry practice. The test house is equipped with a new model Avery Universal tester.

The welfare department includes a licensed canteen organised by the men themselves, a properly-equipped ambulance room, and a sports club, which runs football, cricket, tennis and bowls teams. The apprentices, twelve of whom are on coremaking and twelve on moulding, are encouraged to attend the Medway Technical College, and special facilities are accorded them for this purpose.

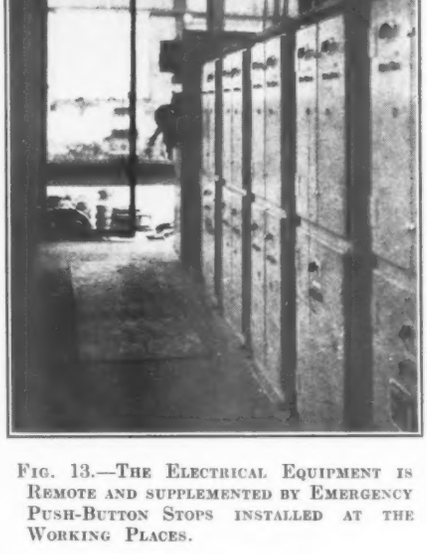

Fig. 13.—The Electrical Equipment is Remote and supplemented by Emergency Push-Button Stops installed at the Working Places.

Unquestionably, much credit must be accorded to this foundry, which has attained considerable dimensions in a very short period of time. The quality of the castings is excellent. The management is ambitious to attain a reputation for high quality, and to have started initially with the production of Meehanite indicates the enlightened outlook actuating the management. We wish to accord to Mr. H. M. Thompson, the foundry manager, our very sincere thanks for the help he has given us in preparing this article, and to his directors for permission to obtain and publish the particulars contained in it.

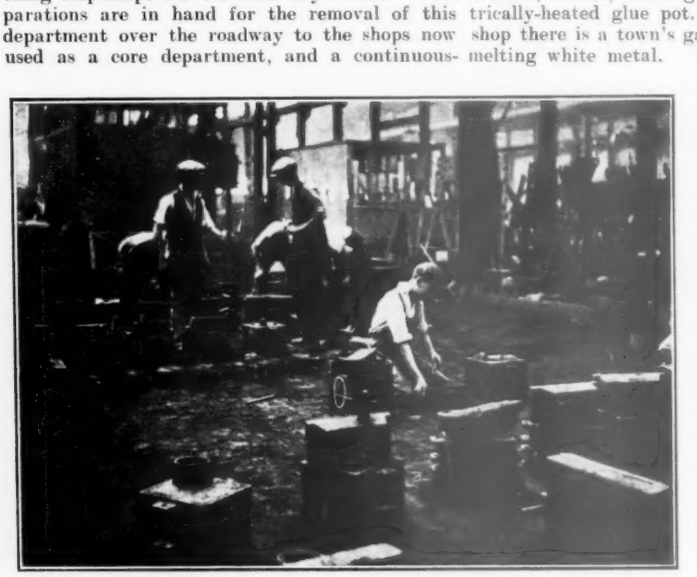

Fig. 14.—A Special Department for the Training of Apprentices has been installed.

Fig. 15.—The Fettling and Inspection Shop. In the Foreground is a Jig Set up for passing the Tolerances of Pallet Plates.

The nature of this foundry demands an alloy stores, and this is under the supervision of the works metallurgist, likewise all cupola control. Herein is housed the sand-testing apparatus. American Foundrymen's Association standards are used, except for moisture tests where reliance is placed upon the "Speedy" machine.

Points from the Presidential Addresses

We much regret that owing to extreme pressure on our space we have found it impossible to reproduce in full the presidential addresses to the various branches of the Institute of British Foundrymen. The following extracts, however, give the main points made by the speakers.

Mr. F. O. BLACKWELL (London)

The address of Mr. Blackwell, who, unfortunately, was indisposed, was presented on his behalf by one of his staff. His address dealt with organisation, a matter which he first brought up for discussion at a meeting of the branch in 1912. As essentials in the future conduct of the foundry industry, Mr. Blackwell cited the work of the various committees of the Institute, the degree course at Sheffield University, and the work of the British Cast Iron Research Association, as they all tended to strengthen the personnel of the industry.

He stressed as the best definition of organisation "Make arrangements for, or get up an undertaking involving co-operation."

What Organisation Involves

After elaborating the importance of general co-operation, Mr. Blackwell pointed out that then the conditions were clear for proper control. This, he said, could only be done by the management knowing in detail what is taking place in every department daily. In some instances results were exhibited hourly. Statistical information was of little value unless it was provided close on the heels of the work being done, was accurate, and was immediately used. Statistical information was not merely a mass of figures compiled only for the managing director; every foreman should have a copy relative to his shop, and it was the duty of the management to obtain his interest in the results shown, to discuss with him the cause of indifferent results, and the remedy to be tried, and to compliment and encourage him when results were good.

Statistics to be presented to foremen should be as brief as possible and contain only the essential information; elaboration became to him confusing and wearisome. Foremen should be encouraged to compare the information presented them with that of the previous day or week, and even with the corresponding day or week of the previous year.

The foundry manager or head foreman should be supplied with statistics which permitted him to see the essential details of the various sections. He was responsible, for instance, for the usual particulars covering the daily working of the cupola; this was, of course, common practice as far as coke, pig, scrap, and flux were concerned. It was of considerable use to show the rate of melt per hour, particularly where the cupola was continuously melting for five or six hours per day, the incidental charges were important to control, viz., the amount of labour working the stock yard, daubing cupolas, lining the hot metal bogies, etc. These all had a tendency to increase, specially at a busy time and failing to decrease when the demand was not so great, thus pushing up the percentage of non-productive costs.

The same applied to non-productive labour in front of the cupola, labour taking the hot metal to moulders, castings to dressing shop, service labour such as changing boxes and sweeping up.

The core dressing shops called for daily records. It would be found the cost of dressing per ton would increase unless carefully controlled, and the only way to really know was by daily records promptly acted upon.

Planning was another important item in organisation. Many businesses had either a planning department or a man solely employed on this work, resulting in every detail of a job being arranged for before it entered the workshop for production.

Essential to good organisation was the necessity for the proprietors of the concern to provide the most modern machinery and tools. However clever the staff and craftsmen were, unless they were equipped with plant at least equal to home and foreign competitors, production was handicapped, costs were higher and business more difficult to obtain.

Methods of instituting organised effort had considerably altered in recent years. Formerly it was built up by the head of the business with the assistance of the principal staff; in many cases to-day it was recognised that the routine duties of the executive staff left no time for working out improved methods and the thin end of the wedge of stagnation entered, so specialists were called in, and their whole time was given to creating an improved organisation which, with the goodwill of the permanent staff, generally resulted in benefit to all concerned, including the employees.

Mr. JAMES SMITH (Newcastle)

Mr. James Smith started his address in a reminiscent vein. "On the 24th of last month I completed 58 years of unbroken connection with the foundry trade. I am sure you will pardon me, therefore, if I claim to speak with a certain amount of authority, having over half a century of experience behind me."

A lad at that time was allowed to leave school at the age of 12, and, in order to get him a job, it was simply a case of saying to him: "What would you like to be—an engineer, a pattern-maker, a blacksmith, a moulder, a coppersmith?"—or any one of a multitude of trades. Once having decided that point, the greatest difficulty had been overcome—there was a job waiting for him.

Education was really of no consequence—his job was there, and he learned it by taking notice of others, and by working from 6 in the morning till 5 at night for five days a week and in his own case on Saturdays from 4 till 1. At that time, too, a lad had to serve at least seven years before he had completed his apprenticeship, and only then was it complete if he had reached 21 years of age. So that if a lad started before he was 14 his period of apprenticeship was automatically lengthened. The only road to success was along the lines of using his brains as much as possible, working extremely hard, and striving in every possible way to become a good *practical* moulder, for there was little or no theory thought of then. There were very few improvement classes of any sort held in the evening, for education as such was a very secondary consideration. As far as the mixing of metals was concerned, for instance, old foundrymen had nothing but a time-honoured rule of thumb to help them. Their fathers used to mix so much of this and so much of that, and, as time went on, others just did the same. In the light of what is known to-day this was surely a crude way of doing it, but remarkable success, nevertheless, attended their efforts, for engines are running to-day—and running well—which were made 30 and more years ago. These are sturdy examples of very satisfactory castings which gave all the service expected of them, in spite of the more or less crude methods employed in their manufacture. There is an example of this in the castings made for the "Mauretania" 30 years ago.

Conditions To-day

The standard of living was to-day immeasurably higher. Educational facilities—particularly with regard to evening classes, both practical and technical, were within the reach of everyone who was willing to grasp the opportunity of making use of them. There are classes which specialise in every branch of the engineering industry, including patternmaking, drawing and moulding, and the younger men were urged to make full use of them in order to expand their knowledge to useful purpose.

Over the last 25 years, science had played an ever-increasing part in the foundry industry. Hand in hand with labour, step by step, some difficulties had been completely overcome, and others made easier. In the mixing of metals, to keep to the previous example, science had helped to a point where tests were being obtained with certainty to-day, and *every* day, which 20 years ago would have been utterly impossible, and metals were being produced by analysis to a truly wonderful degree of exactitude. The whole aspect of foundry work had been changed in the course of the last decade or two, and changed for the better.

After referring to the reasons for unemployment, he gave as his personal view that we in this country had been far too eager to teach the foreigner too much of our own business. We had only ourselves to blame for the fact that we no longer retained the proud position of being, as we were 25 years ago, the workshop of the world.

In this connection he recalled a visit he paid to Italy 5 years ago. While in Trieste he was conducted over one of the largest engineering and shipbuilding establishments. It was a fact that he saw only what he was allowed to see, but he remembered how the clanking of hammers reminded him very forcibly of what the Tyne used to be like, day after day, and year after year. It was well to remember, however, that the Italian yards, at any rate, were heavily subsidised by the Government, but that did not alter the fact that their workmen were turning out a first class job under Lloyd's inspection.

At one time, continued Mr. Smith, all marine castings such as cylinders, condensers, bedplates, pumps and the like, were made in loam, but one pioneer in the person of the late Mr. John Surtees determined to break away from that method and try to make them in dry sand. So successful were his efforts that his numerous friends soon followed his example—such men as Tom Glover, Michael Burley, Robert Hogarth, Claude Wiley, William Napier, and William Mayer. These names, as such, may not convey much nowadays, but to those who knew them they were the real pioneers of the foundry industry at that time, and they succeeded in spite of the rough and ready methods of years ago.

To commemorate the work so successfully accomplished by John Surtees, William Mayer endowed a fund to provide medals and prizes which were to be competed for in alternative years by moulders in the Glasgow and Newcastle Branches. The competitions are known as "The John Surtees Memorial" and it was a source of great joy to him to know that they had a number of young men there who were still keen enough to compete for the trophies.

He paid a very high tribute to the late Mr. James Carmichael, who was responsible more than anyone else for the arranging and smooth working of this Memorial.

Finally, the Branch-President offered a fatherly word to the very young men employed in foundries. "No matter what position you may fill, said Mr. Smith, whether it be in the capacity of workman, and as time goes on, foreman or manager, please never over-estimate your ability, for you will be surprised as you go along how much there is that you do *not* know." Even with 58 years of hard, practical experience behind him, he felt there was a tremendous amount that he had still to learn. A man who over-estimated his ability was bound, through time, to lose grip and become careless, and there was no room for that in a foundry.

In conclusion, the Branch-President urged the great need for co-operation between all branches

of engineering establishments, but particularly in relation to the foundry. He stated that the difficulties which arise in a foundry are known to all, and the fact that they could so easily be avoided by close co-operation between draughtsmen, patternmaker and moulder. The expense and worry of the old methods, which amounted practically to trial and error, were particularly stressed, and it was pointed out that had co-operation been resorted to at the beginning rather than the end, all this would have been avoided. With the advent of the turbine, diesel and other types of large engines, history again repeated itself simply for want of this co-operation which he so strongly advocated. Emphasis was laid upon the fact that the foundry, in practically all cases, had to bear the burden of errors which would so easily have been rectified by a little thought on the part of the various branches of engineering concerned.

The Branch-President said that he offered the suggestion for co-operation in the kindliest possible manner, with no thought of criticism in his mind, and he looked forward to the day when designers and draughtsmen would work hand in hand with the founder. He concluded his most interesting address by the exhibition of a number of slides showing methods employed in foundries thirty to thirty-five years ago, in the manufacture of castings weighing 10 tons and upwards.

Mr. A. WHITELEY (Sheffield)

Mr. Whiteley, who dealt with foundry refractories, said that during the last two decades the refractories industry had changed considerably. Then it was more or less "hit or miss," but nowadays it had progressed so much that it was recognised as a highly-technical trade; at any rate, the production and use of refractory materials were regarded as so vastly important that the Sheffield University provided a special department for studying the subject.

He mentioned also the work of the British Cast Iron Research Association, the Refractory Materials Section of the Ceramic Society, the British Refractories Research Association and the Refractories Association as evidence of the earnest desire of all progressive producers of refractories to provide industry with materials which were best suited for the purpose for which they were intended, and the result of all the investigations which had been made and were now ceaselessly progressing, was that users were receiving refractories of better and more serviceable quality to-day then ever before.

Firebricks

Whatever kind of firebrick was used, foundrymen should insist that supplies were true to shape and size. Too much stress could not be laid on this point, and the advisability of building any firebrick structure with the thinnest possible joints was now recognised as *the* most important factor in prolonging the efficient and effective life of melting furnaces. In fact, one investigator had gone so far as to state that in, say, cupola practice, it was far preferable to use a firebrick which was well made, properly burnt with perfect shape and truth to size but of *low* refractoriness than a brick of *high* refractoriness poorly made and ill-shaped, and consequently uneven and with wide joints.

Modern firebrick manufacturers were now able to furnish perfect bricks in this respect—bricks which were not only mechanically perfect, but of any required degree of refractoriness and of texture, scientifically graded to ensure the maximum service to the user.

A great deal of investigation has been carried out on jointing materials during recent years, and there were cements obtainable which were stronger and more refractory than the firebricks themselves.

Monolithic refractories had come into prominence comparatively recently as a result of the advances made in melting processes, and the introduction of new type furnaces such as the oil fired, or powdered fuel fired rotary furnace, the high frequency electric furnace, etc. When these new melting processes were designed great difficulty was experienced in providing satisfactory and suitable lining material, and much credit was due to the refractory technologists and producers in this country for solving what was admittedly a very difficult problem. Lengthy and exceedingly costly investigations were carried out and the manufacturers were now able to supply efficient materials suitably and scientifically prepared to give guaranteed service under the exacting melting conditions of the furnaces referred to.

Ganister

Modern producers did not just haphazardly grind ganister rock and fireclay together. The selection of the rock, its blending with fireclay, etc., and the grading were all carefully controlled. Scientific investigations had enabled many founders to make a very considerable reduction in their cost of refractories per ton of iron melted.

Moulding Sands and Core Sands

Modern producers did not merely quarry and deliver sands as they occur in a quarry face. The greatest care was taken in selection, and foundries could now specify exactly the sand they required without any doubt that the producer would supply it. Grain size, moisture content, permeability and green strength were all controllable by modern production methods.

Many suppliers had realised the importance of these factors, and producers were taking every precaution to market sands which were to specification and could guarantee supplies of regular uniform quality.

Similarly, in the supply of core sands, core binders, moulders paint, coal dust and parting powders, modern suppliers of these materials had a far wider knowledge than ever before, and were equipped to give foundrymen exactly the right quality and grade for any specific purpose.

Where Founders Could Help

Mr. Whiteley pointed out that founders could co-operate by providing better storage accommodation for stocks of refractory materials. In many foundries stocks of sand, firebricks, ganister were often kept quite in the open or, at any rate, in such positions as offer no protection from the weather. Unquestionably, refractories exposed to climatic changes would deteriorate, and the absence of adequate storage accommodation and protection was scarcely fair to the producer and certainly uneconomic to the user. The cost of provision of proper storage accommodation was quickly and amply repaid by the increased efficiency and longer service of the refractories. Further, he urged that greater consideration should be given to the selection and application of refractories for the particular service they were required to give. Many complaints of failure were attributable mainly to the selection or purchase of refractories which were quite unsuitable.

Refractories, such as firebricks, were often purchased without any real consideration of the actual service conditions they had to withstand, and there were many cases of failure which could have been prevented by a little more frankness and knowledge by the consumer of his actual requirements. When special difficulties were encountered, the refractories producer should be taken into confidence, as all modern manufacturers employed skilled technologists.

Finally, Mr. Whiteley acknowledged the assistance of the Institute to the refractories producer. That the vast importance of refractory materials to the founder was admitted, was quite evident from the fact that the Institute appointed special technical committees to consider sands and refractories. The reports issued by these committees from time to time had been helpful both to the foundry and to the refractories industries.

Mr. A. SCHOLES (Middlesbrough)

The view that the Institute had proved an important factor in the advancement of the foundry industry during the 31 years it had been in existence was expressed by Mr. A. Scholes, the Middlesbrough Branch-President, in his Presidential address. Regarding the Institute's part in the advancement of the metallurgical aspects of the industry, Mr. Scholes pointed out that 30 or 40 years ago the majority of foundry managers and foremen had no use for chemical composition and analysis. In those days iron was judged by fracture. He added "I should imagine there are now few foundry managers who have not some knowledge of the effect of chemical composition on the character of the casting produced, and who do not demand an analysis of the iron supplied to them by the blast furnaces."

Great progress, continued Mr. Scholes, had been made from the point of view of the metallurgical and physical-chemistry side of cast iron. As a result of this progress, not only was the ordinary cast iron a more reliable article than formerly, but special irons had been devised which had the mechanical and physical properties far in advance of any contemplated by the early workers. "For so small an area as ours," concluded Mr. Scholes, "the Middlesbrough Branch is in a very virile condition, and one of the most satisfactory features is the number of Papers on practical subjects that we have had from our own members."

Mr. J. E. Hurst, President of the Institute, said the development and progress of the Institute during the past 25 years had been such that it now ranked among the leading metallurgical institutes, not only in this country, but in the world. The general spirit behind the Institute was towards further development and progress, and in this connection he mentioned that their technical committees had proved of valuable assistance to the industry.

Mr. G. M. CALLAGHAN (Birmingham)

Mr. Callaghan, in his address, dealt with the work of the Institute and its effect upon industry. After quoting the assertion of Mr. C. E. Wiggins, Past-President of the Institute, that the foundry was the foundation on which all civilisation and all social life, as we knew it to-day, had been raised, he substantiated that assertion by outlining the objects of the Institute, such as the reading and discussion of Papers on subjects connected with the foundry trade; the work of the various Sub-Committees; works visits and the Annual Proceedings. As an outcome of these endeavours, Mr. Callaghan pointed to the position now occupied by cast iron as an engineering material. This was due to a better understanding of its physical properties, which was to be associated with the methods of mixing and melting. He acknowledged the help which had been given by scientific metallurgy and had helped in a large measure to bestow such properties as increased strength, freedom from porosity, resistance to wear, shock and corrosion, to cast metals. He also stressed the excellent results which had been obtained from the research work done upon the mixing and grading of sand, refractories and facings. Other subjects which came in for comment were mechanical aids to production, the newer melting processes and casting. His final remarks dealt with the design and construction of foundry buildings. "Many of the tumbledown, ill-ventilated sheds, which have been used as foundries in the past, are being replaced by modern buildings which compare very favourably with any other workshop, and which have been designed with a reasonable consideration for comfort, health and eyesight of the foundry worker." The balance of his address was devoted to matters of local interest.

XUM

Dust Collection in the Foundry*

By S. D. MOXLEY,† Birmingham, Ala., U.S.A.

Undoubtedly the most economical way to meet this problem of dust in the foundry is to do a good job of house cleaning first and then install the proper equipment for eliminating the dust. There are so many kinds of equipment and methods used in the various phases of dust collection and air conditioning that the engineer and foundryman faced with dust problems sometimes become confused while attempting their solution. There is a methodical approach to the problem in every case, and there are a few basic principles involved which, while familiar to most engineers, are not always practised in the foundry. It is the aim of this Paper to clarify some of the points that most commonly cause confusion and result in inefficient and inadequate systems.

Quite often a system is designed for sand conditioning as well as elimination of dust nuisance. The same equipment can perform both of these operations satisfactorily, as usually they are interrelated. It is not often in the foundry that the recovered material has any economic value, therefore, the separation of sizes of particles collected is not important. The problem then naturally breaks down into the following three distinct phases: Apprehension, collection and disposal.

Apprehension

In most cases the apprehension of the dust is the simplest but least understood of the problems. Almost without exception the best place to catch the dust is at the point of creation, as once it is liberated into the atmosphere, it is very difficult, if not impossible, to recover.

Use of Hoods.—It is common practice to provide hoods over dusty areas which are fitted with suction pipes leading to the collector. This is illustrated in a general way by A of Fig. 1. In this type of installation the hood should be as small as possible and the openings in the hood reduced to a minimum. It has been found by the writer that with most foundry dust it is necessary to maintain a velocity in all hood openings of from 250 to 300 ft. per min. to prevent dust escaping from the hood. Fig. 1 B illustrates roughly the use of a small hood attached to a flexible exhaust pipe, which has been used quite successfully in connection with snagging wheels for grinding castings. There are many other variations of this principle used in connection with grinding operations. Fig. 1 C illustrates a close-fitting hood applied where dry sand is fed on a belt. The hood openings are kept as small as possible.

When conditioning sand by removal of fines, it is most effective to pass all of the shake-out sand through a current of air. A successful method of removing the desired size of particles is shown in Fig. 1 D. A constant velocity and volume is maintained in the duct at all times. The end of the duct is provided with a hinged hood having an opening near the sand stream, approximately 50 per cent. larger than the duct itself. This hood can be adjusted to varying distances from the sand stream, which regulates the effective velocity through the sand stream and hence the particle size removed from the sand. As the air velocity in the duct is always greater than at the opening of the hood, any particle which is picked up at the hood opening will surely be carried in suspension to the dust collector with no clogging of the air duct.

A method of controlling dust known as the air curtain dust control system has recently been developed and patented which has proved quite successful. Fig. 1 E illustrates its application to a shake-out station. A pressure box is provided with thin slots on the top and sides which keeps a thin layer of air moving at a high velocity over and around the shake-out operation. This prevents the dust generated in the shake-out operation from passing through the air curtain and into the atmosphere. At the other end of the station is a suction hood which receives the projected air curtain and exhausts it along with the dust laden air arising from the shake-out. The air is passed through equipment which removes the dust before it is re-circulated.

In sand-conditioning machinery, where the sand is handled in many types of machines and conveyors, there are of necessity large amounts of dust created. It is usually possible, although sometimes inconvenient, to provide practically all such equipment with hoods which are exhausted to a dust collector. The removal of fines for sand-conditioning purposes should be done at the shakeout while the sand is hot, as this is usually the first point of origin of dust in the plant. If separation is made at this point there would naturally be less dust to escape in the remaining operations. Oftentimes it is almost impossible to provide suitable hoods for shake-out and cleaning stations. In such cases these departments can be enclosed or moved to a distance from the other operations to prevent atmospheric contamination in the rest of the plant. The men in these departments may be provided with suitable respirators of the positive pressure type. It is now the general opinion in the industry that the filter type respirator is ineffective.

Correct Design of Hood Pipes.—Correct design of the pipes connecting the hoods to the dust collectors is essential to an efficient system. Branch lines should enter the main at the smallest possible angle, and the main should be increased in size proportionately at each connection to prevent variation in the velocity of the air. These branch lines should enter the sides of the main. Dust pipes which incline downward in the direction of flow usually give trouble by clogging.

A system should contain as few elbows as possible and they should be of the longest radius permissible and never less than 1½ times the diameter as measured on the centre line of the elbow. Ordinary foundry dust can be handled with little clogging of the pipes by an air velocity of between 2,500 and 3,000 ft. per min.

Collection

Types of Collectors.—In dust-collecting equipment for sand conditioning and dust-nuisance prevention in the foundry, the following types of equipment usually are considered:—Centrifugal; centrifugal (fan type); cloth screen; cloth bag; electrical precipitation; washer, and froth flotation. Each of these types has distinct advantages in certain fields, and the writer believes there is no particular type that can be economically and satisfactorily applied to all problems. It should be remembered that every dust-prevention job is more or less peculiar in itself, and the equipment selection should be the one best adapted to all phases of the problem.

Dust Characteristics.—Fig. 2 shows certain characteristics of dust, and the general range of the various types of dust-collecting apparatus with reference to recovery. This chart, reproduced from the original supplied by the American Air Filter Company, Inc., has been

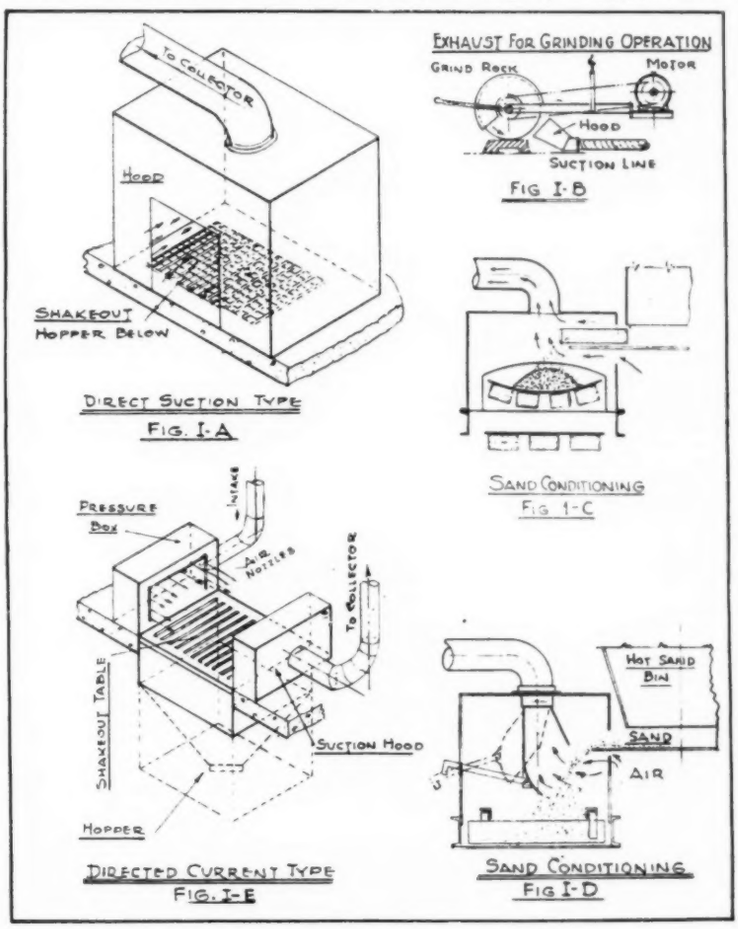

Fig. 1.—Typical Devices for Trapping Dust.

* Paper presented to the Annual Meeting of the American Foundrymen's Association.

† Chief Engineer, American Cast Iron Pipe Company.

modified slightly by the writer with reference to range of recovery of grain sizes by some of the equipment suggested for recovery. This has been done to make it more applicable to foundry dusts.

TABLE I.—*Dust Collector Characteristics.*

Type.	Style.*	Vol. air Per sq. ft cloth.	Min. grain size microns.	Temperature limits.	Moisture limits.	Maximum Dust Concentration inlet grs. cub. ft.	Concentration outlet 5 gr. inlet.	Efficiency 5–10 grs. conc. Per cent.	Relative cost 15,000 cub. ft. unit
Centrifugal Collectors	A	—	70–75	800 deg. F.	Dewpoint	Any	0.75	85	$750
	B	—	70–75	800 deg. F.	Dewpoint	Any	0.75	85	1,000
	C	—	50–60	850 deg. F.	Dewpoint	Any	0.50	90	2,000
	D	—	35–40	800 deg. F.	Dewpoint	Any	0.25 to 0.10	95 to 98	2,500
	E	—	35–40	1,800 deg. F.	Dewpoint	Any	0.25 to 0.10	95 to 98	3,000
Centrifugal Fan Type	F	—	35–40	750 deg. F.	Dewpoint	150	0.50	90	2,000
Cloth screen ..	G	2 cub. ft. 10 gr. 3 cub. ft. 5 gr.	5–10	200 deg. F.	20 deg. above Dewpoint	10	0.05 to 0.025	99 to 99.5	4,000
Cloth bag ..	H	4 cub. ft. 10 gr. 6–8 cub. ft. at 5 gr.	5–10	Cotton 200 deg. Wool 250 deg. F.	20 deg. above Dewpoint	20	0.05 to 0.025	99 to 99.5	6,000
Electrical precipitation	I	—	Any suspnd'd particle	None	None	Any	—	—	10,000
Washer ..	J	—	5–10	Boiling point of of liquid	None	—	—	—	3,000
Froth flotation	K	—	5–10	Boiling point of of liquid	None	25	0.017 and up	99.7	4,500

* For detail sketches or illustrations of apparatus of these styles, see Figs. 1, 3, 4, 5, 6, 7 and 8.

The dust to be recovered should be analysed for the following:—(*a*) The nature of the dust from the standpoint of grain size and percentages of the various sizes of particles; (*b*) specific gravity; (*c*) amount of clay or other sticky substances contained; (*d*) moisture; (*e*) temperature, and (*f*) the degree of fineness it is necessary to collect (this factor is usually determined by the shop conditions and the proximity to the surrounding communities).

Hood Openings.—Next, the hoods at the various points of collection should be designed and the areas of hood openings determined. With known velocities the volumes of air can be determined and correct design of air ducts made. These calculations will also show the volume of air to be handled by the dust collector and the pressure under which the system is to operate.

If possible, the probable dust concentration per cubic foot of air which will be delivered to the dust collector should next be determined. Usually, all of this information can be determined by the local engineer in co-operation with testing laboratories or engineers representing manufacturers of dust-collecting equipment. When these facts are obtained, the chart of Table I will assist in the selection of the proper equipment.

Dust Collector Characteristics.—Table I shows general characteristics of the various collectors when collecting dust, which the writer believes is fairly typical of that found in the foundry. The results shown are based on tests run on dusts arising from shakeouts and sand conditioning machineries in continuous moulding operations and the jobbing foundry practice of the American Cast Iron Pipe Company. The following indicates the general characteristics of this dust:—50 to 60 per cent. through 325 mesh sieve; 2.5 true specific gravity; 33 per cent. clay; 1 per cent. moisture; 5 grains per cub. ft. concentration.

The values shown for volumes of air per sq. ft. of cloth, minimum grain sizes, temperature and moisture limits and maximum dust concentrations represent what the writer believes to be within safe practice for satisfactory operation. Each will collect small portions much finer but will also allow certain quantities of much coarser material to escape. The temperature limits indicated assume that no form of heat exchanger is used in the system.

Outlet dust concentrations of collectors shown as styles A, B, E, F, G, and H have been determined by the writer using the impinger method. The efficiencies were then calculated based on the above conditions. The values given in Table I for the remaining collectors were obtained from reported tests made elsewhere and from such information as was available. Installation costs are based on average conditions. Due to the wide variations in foundry conditions all of these values should be used only for comparative purposes.

Centrifugal Collectors

Examination of the characteristics of centrifugal collectors A and B of Table I will readily show that these styles are only suited to coarse material, and are not able to collect, with any high degree of efficiency, fine foundry dust. Their usual application is in sand conditioning, exhausting tumbling barrels, etc., rather than preventing pollution of the atmosphere. These general types are familiar to foundrymen. (Fig. 3, A and B.)

Style C, Table I, indicates reported characteristics of a centrifugal cone collector, which consists of a number of small centrifugal cones connected as a unit (Fig. 3 C). Styles D and E Table I (Fig. 3 D and E), show the more efficient styles of centrifugal collectors. The double scroll type, shown as style E, is one of the most efficient of the centrifugal collectors from the standpoint of collection of the finer particles. The skimmer-type collector is shown as style D (Fig. 3 D), which has a relatively high efficiency in collecting fine particles.

The characteristics of the fan-type centrifugal collector are given as style F, Table I. It is a combination fan and centrifugal collector driven by an electric motor (Fig. 3 F).

If the dust concentration be high, and the percentage of fine particles be high, with a relatively low specific-gravity dust, these types of collectors cannot be depended upon to solve a dust nuisance. When 50 per cent. or more of a dust passes through a 325-mesh screen these types of collectors are apt to release into the atmosphere objectionable amounts of dust. This

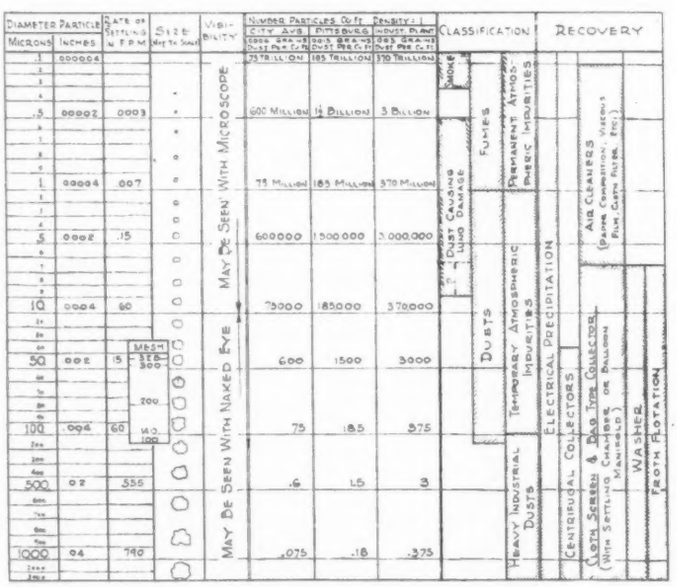

FIG. 2.—SIZE AND CHARACTERISTICS OF AIR-BORNE SOLIDS (REPRODUCED BY PERMISSION OF THE AMERICAN AIR FILTER COMPANY. SLIGHTLY MODIFIED BY S. D. MOXLEY WITH REFERENCE TO RANGE OF RECOVERY OF GRAIN SIZE AND THE EQUIPMENT SUGGESTED FOR RECOVERY).

is particularly true when a large proportion of these fine particles is clay or other binding materials of impalpable character. However, on dusts having high specific gravity such as pure silica sand, this type of machine can be efficient in the collection of extremely fine particles.

Cloth-Screen Collectors

The cloth-screen filter, which has found wide application in the collection of foundry dust, has characteristics shown under Style G, Table I (Fig. 4). Where it is necessary to collect the extreme fines, and where the dust concentration per cub. ft. of air is not high, this type of equipment has proved most efficient. The limitations of this apparatus are usually found in the amount of moisture in the air, the temperature, the nature of the dust and the dust concentration of the air stream.

Where high concentrations are combined with relatively high percentage of very fine particles, and where the particles themselves are composed of clay or other sticky substance with moisture

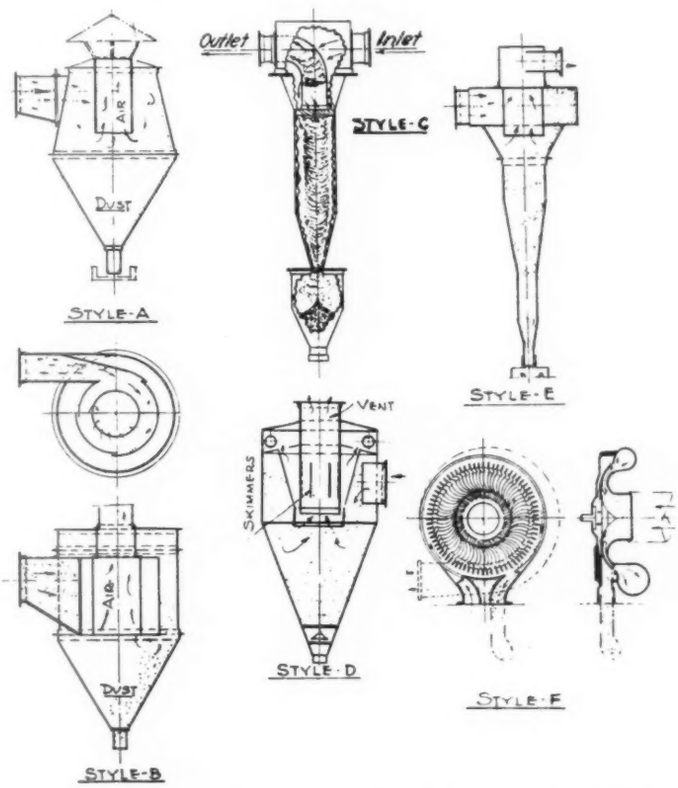

Fig. 3.—Six Styles of Centrifugal Dust Collectors. Style F is a Fan Type Centrifugal Collector.

included, the shaking mechanism is usually found inadequate to clean the cloth screen. This shaking is usually done by mechanically-operated rappers, and the air must be cut off during the rapping operation. Practically any-size material can be collected efficiently by this type of apparatus if it is provided with an expansion chamber or balloon-type manifold which will first settle out of the air stream the larger particles.

Cloth-Bag Collectors

For the higher concentrations of dust and the greater percentages of impalpable fines the bag-type cloth filter of Style H, Table I and Fig. 5, has been found more satisfactory. It is also more effective on relatively high-moisture conditions. The reason for this is that the bag-type collector has a much more effective shaking mechanism. The collecting unit is divided into compartments, each containing from 15 to 18 bags suspended on a rack which is shaken by pneumatic equipment. During the shaking period the compartment is disconnected from the fan and the direction of the air is reversed. The compartment is then automatically cut into service while another compartment is disconnected for shaking. By this arrangement only a small part of the capacity of the collector is removed from service during the shaking operation. Large amounts of moisture can be handled by the bag-type collector with little difficulty if the temperature of the air is kept some 20 deg. Fah. above the dew point.

Electrical Precipitation

Another type of dust-collecting equipment which may require consideration in the collection of foundry dust is the electrical precipitator. Characteristics of this equipment are given in Table I. The principle of operation is to pass the dust-laden air through a strong electrostatic field, where the dust particles are ionised. In this condition they will be attracted by the electrodes of opposite polarity.

A simple form of the apparatus is shown as Fig. 6, where a fine wire is suspended in and insulated from a vertically mounted pipe. By electric connection the pipe acts as the positive electrode and the wire as the negative electrode. Dust-laden air passing through the pipes becomes a part of the electric circuit, and is ionised, caused the suspended particles to be precipitated on the interior of the pipe. Another form of this apparatus is also indicated (Fig. 6) where vertically-supported concrete slabs form the positive electrodes, while vertically-suspended wires between these slabs form the negative electrodes. In this case the ionised dust particles are attracted to the sides of the concrete slabs. They are discharged by gravity into hoppers below. Sometimes mechanical scraping or cleaning devices are used to remove the precipitated dust.

The efficiency of this type apparatus on fine particles can be very high if the equipment is designed properly. The writer does not know of an installation of this kind being used for the collection of foundry dust. The reason it has not been used in this field, probably, is the high initial cost of the equipment. With the rapid improvements now being made, this disadvantage may shortly be overcome.

Style J (Fig. 7) shows an adaptation of the wet dust collector principle which has recently been applied to the collection of foundry dust. The dust laden air is introduced at the bottom of the tower tangentially. Water or other absorbing liquid enters the top of the tower and

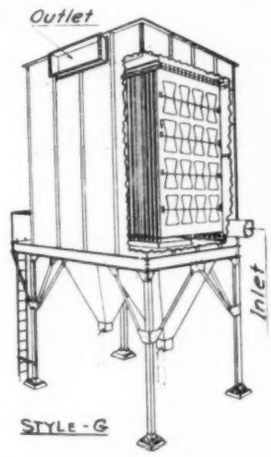

Fig. 4.—Cloth Screen Filter.

falls in a spray through succeeding plates, making contact with the upward moving dust-laden air. Vanes are mounted on the bottom of the centre plates which cause the air to travel upward in a spiral course. There are two washes per plate and usually six plates or twelve washes are used.

The collected material is absorbed in the liquid and flows by gravity from the bottom of the tower into settling tanks. The water from these tanks is recirculated in the tower and the sediment is disposed of by the most convenient means.

In Table I there are given reported characteristics of a collector of this type (Style J). The

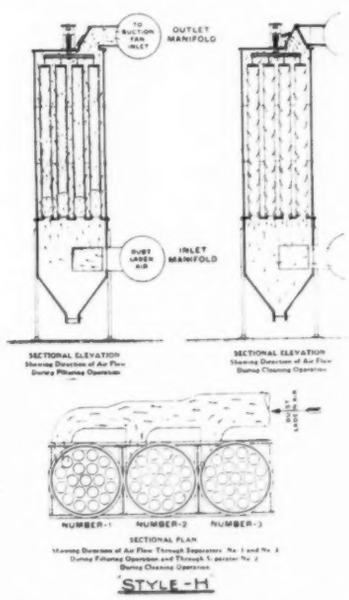

Fig. 5.—Bag-Type Cloth Filter.

claims made for this equipment are beyond the performance of the usual type of scrubbers or air washers which have been tried in the dust-collection field. The author has indicated such characteristics as were available without having them verified.

An equipment using oil flotation which utilises the bubble tower principle is shown as Style K (Fig. 8). This newly-developed apparatus was announced and displayed about a year ago. Dust-laden air is drawn through ducts to a distributing chamber. The air passes upward through thimbles and is deflected downward by means of hooded bells passing first through water and then through a froth filter carpet. The filter carpet is obtained by frothing oil on the surface of the water. The dust trapped in the wetting agent is floated over an adjustable weir

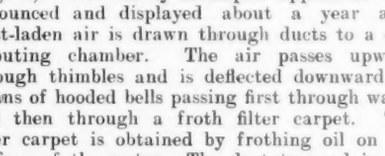

Fig. 6.—Two Electrical Precipitation Type Collectors.

to a settling chamber. The cleaned air passes to the exhaust manifold and into the atmosphere.

The characteristics shown for Style K in Table I are based on tests made in the laboratory of a well-known technical school. These tests were made using dusts similar to that encountered in the foundry. Additional time and practice will be required to determine the full scope of application of this equipment in the foundry dust-collecting field.

Other Types

Attempts have been made to adapt many other types of collecting equipment to foundry dust, such as the dry air filter using a paper composition filter medium, the viscous film filter, and the usual types of air washers. Little success has been met with these types of equipment in the foundry dust-collecting field, as they are either not suited to the type of dust, or the dust concentration is far beyond the range of the equipment. For these reasons, they have been purposely omitted from this Paper. The dry-air filter is effective in cleaning air for ventilating and positive-pressure respiratory systems, as the viscous-type filter is suitable for cleaning air to compressors. Such services are not within the scope of this Paper.

Disposal

The disposal of the collected dust often presents a real problem, as once the dust is collected it must not be liberated into the air. There are many types of equipment such as screw conveyor loaders, etc., which can be adapted to most installations. Often the dust is so fine that it cannot be transported in open wagons or cars and if air-tight wagons or cars are used, the vibration in transit settles the dust so that the whole mass becomes hard and cannot easily be discharged. A method of overcoming this difficulty, which has been used quite successfully, is to discharge the dust into an agitated water tank some 2 ft. below the surface of the water, thus mixing a sludge composed of water and dust. This sludge can be readily pumped to the disposal point by suitable sludge pumps. After each pumping the sludge line should be thoroughly purged with clean water to prevent settlement in the line.

Power and Maintenance

The power requirements of the various dust collecting equipments will depend altogether on the particular installation. In centrifugal collectors of the low-efficiency type it may be as low as 1 h.p. per 1,000 cub. ft. of air per min. and as high as 3 h.p. in the high-efficiency unit, where it is necessary greatly to increase the air velocity in the collector in order to collect a greater proportion of the extreme fine particles. In general, it can be said that the maintenance of these types of machines is relatively low, as the only upkeep involved is caused by abrasion on the collector and fan. The fan is usually protected by being placed at the outlet end of the collector, thus handling the finer and less abrasive particles. To overcome this wear, the centrifugal-fan type collector has a rubber lined rotator and casing when installed for abrasive dust.

The power required in cloth collectors will vary from 1 to 2 h.p. per 1,000 cub. ft. of air per min. depending upon the relative size of the equipment and the concentration and nature of the dust. Maintenance is relatively high because of screen and bag replacement. Also, the equipment is more elaborate as there are more moving parts to keep in repair and adjustment.

In the washer-type collector the air velocity is relatively low with a corresponding low power requirement of 1.5 h.p. per 1,000 cub. ft. or less. The water recirculated will contain relatively large amounts of dust unless large and hence expensive settling tanks are provided. But to the small amount of water recirculated, the total cost of pump maintenance would not be high. The power requirement for the oil-flotation collector is approximately 1.5 h.p. per 1,000 cub. ft. The water and settling tank requirements approximate those of the washer type. Only a small amount of low cost oil is required.

Conclusions

In solving a foundry dust problem there are many factors to be considered. In northern

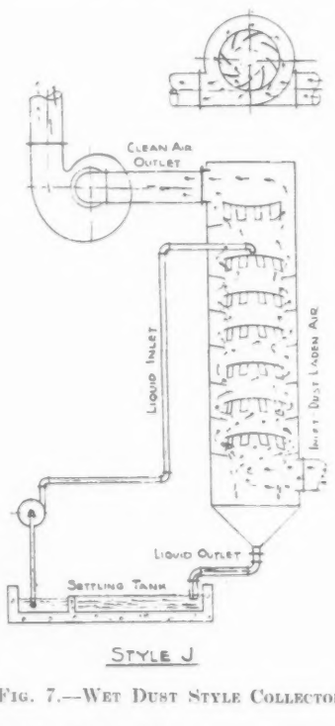

Fig. 7.—Wet Dust Style Collector.

climates the shop buildings are necessarily completely enclosed and the operations compact. Many of them are in densely-settled communities. Such conditions demand highly-efficient dust-collecting equipment which in some cases might approach air-conditioning practice. In hot climates there are open-type buildings with maximum natural ventilation in thinly-populated areas. Under such conditions a much higher dust concentration can be discharged from the operations without undue pollution of the surrounding atmosphere.

Weight efficiencies of dust collectors are of little value unless considered along with a complete analysis of the dust to be caught and the operating conditions. The percentage of silica has a direct bearing on the problem. Some workers in the field have recommended the maximum number of particles per cub. ft. based on

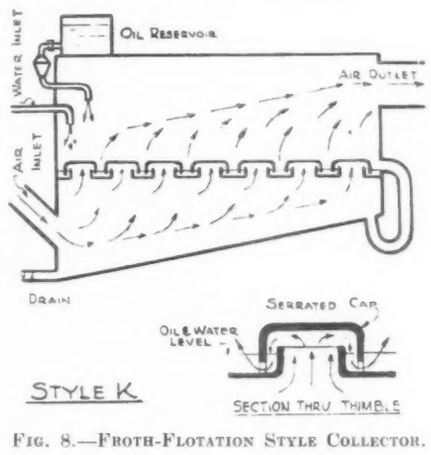

Fig. 8.—Froth-Flotation Style Collector.

certain free silica content for safe atmospheric working conditions.

Rather than efficiency, a more satisfactory way of expressing effectiveness would be the concentration and dust count of the air exhausted from the collector. Such information can be readily obtained by various apparatus such as the impinger dust sampling apparatus as used by the United States Public Health Service. These values could then be compared with those thought to represent safe atmospheric working conditions. These data would indicate the advisability of discharging a collector into an enclosed building.

It is for the engineer and the foundryman properly to analyse the problem at hand, and to ascertain the degree of fineness of dust it is expected to collect before attempting to choose the collector. Since any type of collector will collect a certain amount of real fine particles, in general, it is better to have an inefficient collector than no collector at all. If the dust be collected immediately at the point of its creation, the chances are good that the dust found in the general atmosphere of the shop will be within reasonable safe limits.

Catalogue Received

A High-Duty Refractory. Claims of a very serious and interesting character are made for H.T.I.—a new refractory brick—in an exceedingly well-produced brochure issued by Gibbons (Dudley), Limited. These claims include an insulating value approximately six times that of ordinary firebrick, perfection in shape, as the surfaces are machined finished, great mechanical strength, high refractoriness, and no after-contraction. Some of these claims are substantiated by tabular matter and graphs. Amongst the illustrations are those of a perfect wall—its perfection being due to the machined surfaces—and a few special shapes. We counsel our readers to obtain a copy of this brochure, as it discloses what we believe to be a new and interesting development.

Messrs. Smith's Dock Company, Limited, South Bank-on-Tees, have received an order for a Diesel-electric tug from the Erith & Dartford Lighterage Company, Limited, London.

British Foundry School

The Governing Body of the British Foundry School announces that the School opened for its first session on October 15. The Governing Body is comprised of representatives of institutions and firms supporting the scheme, and ample provision exists for the representation of subscribing firms, from whom additions to the Governing Body will be made.

The School is supported financially by the leading scientific and technical institutions, research associations and manufacturers' associations in the industry, the list being as follows:—British Cast Iron Research Association; British Iron and Steel Federation (Iron and Steel Industrial Research Council); British Non-Ferrous Metals Research Association; Institute of British Foundrymen; Institution of Automobile Engineers; Institution of Mechanical Engineers; Iron and Steel Institute; National Light Castings Ironfounders' Federation, and Welsh Engineers' and Founders' Association.

The School also has the support of the Institute of Metals and the City and Guilds of London Institute.

The Governing Body is at present as follows:—Mr. R. G. Hosking (Chairman); Alderman W. Byng Kenrick (Vice-Chairman); Mr. J. G. Pearce (Hon. Adviser and Hon. Treasurer); Mr. G. L. Bailey (British Non-Ferrous Metals Research Association); Mr. John Belliss (Institution of Mechanical Engineers); Mr. W. R. Blair (National Light Castings Ironfounders' Federation); Mr. E. R. Briggs (British Cast Iron Research Association); Mr. W. E. Clement (Welsh Engineers' and Founders' Association); Mr. E. W. Colbeck (Imperial Chemical Industries, Limited); Mr. H. E. Cookson (Iron and Steel Institute); Mr. E. C. Evans (British Iron and Steel Federation); Mr. F. Hickinbotham, J.P. (Birmingham Education Committee); Mr. J. E. Hurst (Institute of British Foundrymen); Mr. J. E. Montgomery (Institution of Mechanical Engineers); Mr. B. Pontifex (City and Guilds of London Institute); Mr. P. Pritchard (Institution of Automobile Engineers).

Advisory Members.—Dr. D. S. Anderson (Principal, Birmingham Central Technical College); Mr. R. W. Blount, H.M.I. (Board of Education); Dr. F. T. Chapman, H.M.I. (Board of Education), and Dr. P. D. Innes (Chief Education Officer, Birmingham)

Secretary.—Mr. G. H. Rogers.

The School provides a course of one year's duration for men of practical experience in the industry and with suitable preliminary education, to equip them for posts as foundry engineers, metallurgists and managers. All kinds of foundry work are dealt with, grey and white cast iron, chilled cast iron, malleable cast iron, cast steel and cast non-ferrous metals. The fee is £30, and a diploma will be awarded to successful students.

Chairman.—Mr. R. G. Hosking, who has been elected Chairman of the Governing Body, was educated at Truro School and the University of Leeds and after an engineering apprenticeship, became associated with the British Thomson-Houston Company, Limited, Rugby, where he was ultimately appointed to a responsible executive position as assistant works manager. In 1932 he became a director of S. Russell & Sons, Limited, Leicester, and of Warsop Petrol Drill and Tools, Limited, Nottingham.

Mr. Hosking holds and has held an extraordinary variety of offices connected both with industry and education. He is a Past-President of the Leicester and District Association of the Engineering and Allied Employers' National Federation, and a member of the Administration, National Negotiating and Central Conference Committees. Rugby is well known as the only centre in the country which has a scheme of compulsory part-time education, and Mr. Hosking is a member of the Warwickshire Higher Education Committee and Chairman of the Governors of the Rugby College of Technology and Arts, as well as Chairman of the Rugby and of the Warwickshire Juvenile Employment committees. He was a member of the Committee appointed by the Board of Education on examinations for part-time students, usually known as the Atholl Committee, and is Chairman of the Joint Committee on Design and Equipment of Technical College Buildings, which has recently issued a very comprehensive report. Mr. Hosking is a member of the Executive Council of the Foremen's Mutual Benefit Society and of the Education Committee of the British Cast Iron Research Association. He is an Immediate Past-Chairman of the Association of Technical Institutions and is actively interested in the British Management Council.

Vice-Chairman.—Alderman W. Byng Kenrick, who has been elected Vice-Chairman, has been a member of the Birmingham City Council since 1914. He was Lord Mayor in 1928 and elected Alderman in 1929. He was elected Chairman of the Birmingham Education Committee in 1922 and still occupies that position. Alderman Byng Kenrick is a director of the family firm of Archibald Kenrick and Sons, West Bromwich, makers of light castings.

Hon. Treasurer and Hon. Adviser.—Mr. J. G. Pearce, Director of the British Cast Iron Research Association, has been elected Honorary Adviser to the School and also Honorary Treasurer.

Lecturer-in-Charge

The Governing Body has appointed Mr. James Bamford as Lecturer-in-Charge of the School. Mr. Bamford followed a complete five-year apprenticeship in the foundries of the British Thomson-Houston Company, Limited, on work including all sizes of moulds and cores in dry and green sand and loam, by actual experience on the foundry floor. He subsequently took a complete four years' apprenticeship in the drawing offices, engineering shops and research and testing laboratories, and since completing this has had three years' experience as technical assistant to the foundry manager. Mr. Bamford has taken three ordinary and higher National Certificates in Engineering, the B.Sc. Degree in Engineering of the University of London, and has also had some part-time teaching experience. He is therefore exceptionally well equipped for his new post, and has already taken up his duties.

Admission of Students

Twelve students have registered for the first session, being nominated by the following companies:—Midland Motor Cylinder Company, Limited, Birmingham; Babcock & Wilcox, Limited, Renfrew; Booth & Brookes, Limited, Burnham-on-Crouch; Craven Bros., Limited, Reddish, Stockport; John Rhodes & Sons, Castleford; London Midland & Scottish Railway Company; Manganese Bronze & Brass Company, Limited, London; J. Stone & Company, Limited, Deptford; Vickers-Armstrongs, Limited, Barrow-in-Furness; Nuneaton Engineering Company, Limited, Nuneaton; Egyptian State Railways.

This list contains firms having iron, steel and non-ferrous foundries, and it is of interest to note that the large majority of firms on the list are members of the British Cast Iron Research Association and/or of the British Non-Ferrous Metals Research Association.

Nominating firms have in most cases arranged to provide fees and maintenance for their students. There is nothing, however, to prevent students at present unattached to a particular foundry applying for admission, and, at any rate in some areas throughout the country, it will be possible to arrange for such students to be assisted by their local education authority. Such students are invited to get into touch with the authorities of the Foundry School.

Associate Lectures

A feature of the School will be the delivery of lectures on particular parts of the course by men who are nationally recognised as specialists in the spheres they have made their own. This has the great advantage of putting the students into personal touch with the leading authorities in the industry and with the very latest developments as they take place.

Co-operation of Education and Industry

Those responsible for the promotion of the new School owe a deep debt of gratitude to the Board of Education and the Birmingham Education Authority for their very warm and practical sympathy with the scheme. The School will be governed by, and the expenditure of funds controlled by, the Governing Body, and the School thus offers those engaged in the industry an opportunity of discharging their responsibilities for the training of those employed in it. Great difficulty is experienced in finding men suitable for executive posts in foundries, and this is particularly the case when men are required to combine practical experience with knowledge of modern metallurgical developments. The School should go far in repairing this deficiency. A number of people have asked whether facilities for evening study can be arranged. This is not practicable—the School is not likely to be large enough to be housed in its own buildings, because it is considered that the present requirements of the industry would be met by a maximum of thirty students per annum. Furthermore, there are many advantages to be gained by having access to the staff and equipment of the Technical College. The accommodation, however, which is available for the School in the daytime is occupied during the evening, and it is estimated, in any case, that the complete course would occupy seven or eight years on the usual basis of evening study. Short courses on special subjects, however, will be arranged during holiday periods if a demand arises.

Finance

It is estimated that the annual cost of the School, less receipts from students' fees, will be £2,000. Subject to the industry raising the sum of £500 per annum, the Board of Education has undertaken to furnish the remainder as grant. The group of co-operating institutions listed above has undertaken to provide towards the first year's working the sum of £195, and contributions have also been received from the industrial firms and persons shown in the list given below, totalling £208. The sum of £97 is therefore required to make up the £500 from the industry for the first year's working, and contributions are invited from those firms and persons who are interested and who recognise the importance of the scheme.

	£	s.	d.
Babcock & Wilcox, Limited, Renfrew	25	0	0
Sir W. H. Bailey & Co., Ltd., Salford	3	3	0
Belliss & Morcom, Ltd., Birmingham	10	10	0
Birmingham Aluminium Castings (1903) Co., Ltd., Smethwick ...	10	10	0
Blakey's Boot Protectors, Ltd., Leeds	10	10	0
Boving & Co., Ltd., London	5	5	0
British Pigirons, Ltd., London ...	5	5	0
Sidney Flavel & Co., Ltd., Leamington	5	0	0
John Harper & Co., Ltd., Willenhall	5	5	0
Heritier, Ltd., Birmingham	5	0	0
F. A. Hughes & Co., Ltd., London ...	5	5	0
Imperial Chemical Industries, Ltd., London	50	0	0
Manlove Alliot, Ltd., Nottingham ...	5	5	0
Mavor & Coulson, Ltd., Glasgow ...	5	5	0
Northern Aluminium Castings Co., Ltd., London	10	10	0

(Concluded on page 318.)

XUM

Castings

By W. MACHIN and M. C. OLDHAM

(*Concluded from page 280.*)

Blowholes

Another type of defect is that called the blowhole, due to gases which are generated from the facing sand or facings, moisture in the mould, choked vents from cores, or from incorrectly-melted metal. The defect, shown in Fig. 123, was caused through a core under the feeder not having had the vent released, or, in other words,

FIG. 123.—BLOWHOLES BENEATH THE FEEDER LOCATION.

the vent had been choked, the moulder not having given the attention he should have done in its release through the mould.

It will be seen that two of the other positions in the casting from which the feeders have been removed are clear of blowholes, which would not have been the case had the blowholes been caused through moisture in the mould, the defect in the latter instance usually causing the blowholes to be more generally dispersed over a large area of the casting, a little distance away from the runner.

A typical blowhole defect as shown in Fig. 124, due to moisture or gas generated in the mould from sand or facings. It will be observed that this casting is covered with blowholes on the reverse side to that upon which it was run. The cause of this is the hot metal at this position drying away the moisture or burning away the gas.

The metal during pouring under these conditions is considerably lower in temperature when it reaches the opposite side of the mould, due to having passed through the moisture, which, in a warm dry-sand mould, is in the form of a vapour. The result is that the moisture passes through the metal, which solidifies quickly and causes the defect "blowholes." The metal in the mould under such conditions is very agitated.

This defect in Fig. 125 was caused by gases occurring in the metal and being subsequently released on cooling. The metal has swollen back through the feeder, due to the steel not being thoroughly killed when tapped from the furnace. The blowhole defect is not associated with shrinkage defects or contraction troubles, which cause hot tears. Castings are frequently cut up so that specimens may be obtained for microscopic examination, and while such procedure may be regarded as costly, valuable information has been obtained thereby for the foundryman as a result of the metallographer's work.

Causes of Blowholes

The cause of blowholes has been mentioned, and the two main types are as follow:—(1) Gases occurring in the metal as cast, and subsequently released on cooling, as shown in Fig. 128, and (2) gases from the mould. As regards (1), such gas in the case of steel is liberated from imperfectly killed steel, which causes blowholes of bright appearance. Aluminium alloys are particularly susceptible to the solution of gas, which is liberated on cooling, and causes the well-known "pinhole" defect.

Much difficulty is also often experienced from this cause in bronze, a metal which readily takes up furnace gases when heated to high temperatures. Gases are dissolved in quantities proportional to the square root of the pressure, so that natural-draft furnaces are considered superior to forced draft on this account. It is also agreed, that the actual composition of the furnace atmosphere is of considerable importance in this respect. By rapid cooling, such gases may sometimes be retained in solution in the metal and sound-looking castings obtained, but such methods are poor substitutes for careful control of melting condition, as under such conditions the material does not give the required mechanical properties.

As regards (2), it has been mentioned that the troubles may arise from air entrapped in the mould or from the materials from which the mould has been made, or may occur as a result of inadequate venting or insufficient porosity of the sand. These holes usually have an oxidised appearance. If due to moisture from the mould, the metal surrounding the hole will be decarburised, and microscopic examination will reveal this.

Fig. 126 shows such a hole, surrounded by a decarburised area, and this effect may occur to a considerable depth. Where the hole is due to entrapment of air, the metal is decarburised to

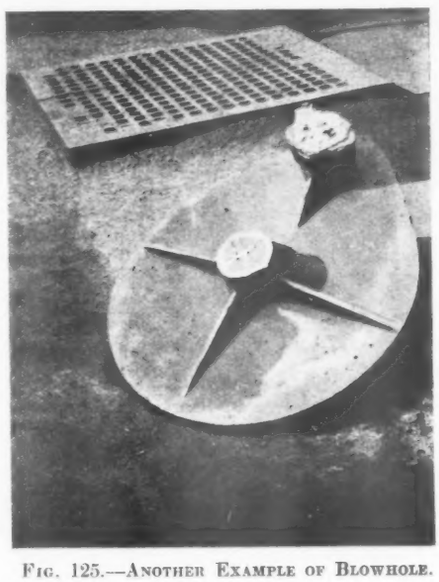

FIG. 125.—ANOTHER EXAMPLE OF BLOWHOLE.

a very slight depth only (Fig. 127). These blowholes are usually found round the edges of the casting, at the most remote position from the runner or inlet, where the metal is in a sluggish condition.

Scabs

The defect shown in Fig. 128 can arise from various causes, the main one being careless moulding. The position of casting in this instance was the bearing face uppermost, so that feeders could be used over the joint face. By this method the core is hung in the top half of the mould, and that any sand in the mould would

FIG. 124.—BLOWHOLES IN CASTING RUN AT POSITION MARKED (X).

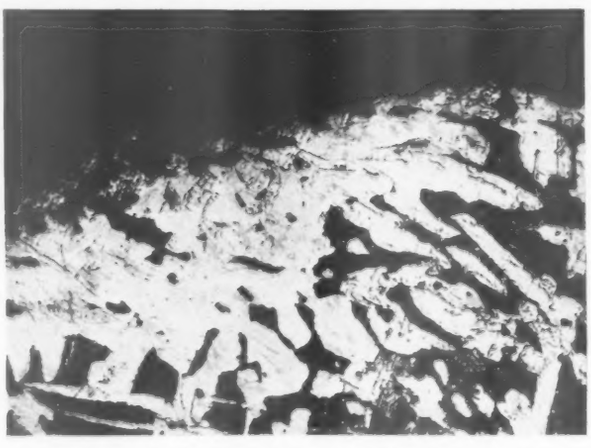

FIG. 126.—BLOWHOLE CAUSED THROUGH MOISTURE IN MOULD.

rise with the metal and get trapped under the core. It is usual in cases of this kind to allow extra metal for machining to clean this away and thus leave the casting clean.

The many reasons for this defect are scabs on moulds or cores due to moisture, bad vents, or faulty sand, all three items causing the scab. The moulder's term "scab" really means the result of sand breaking away from the mould or core and mixing with the metal. In addition, the moulder may carelessly leave dirt in the mould during the closing operations.

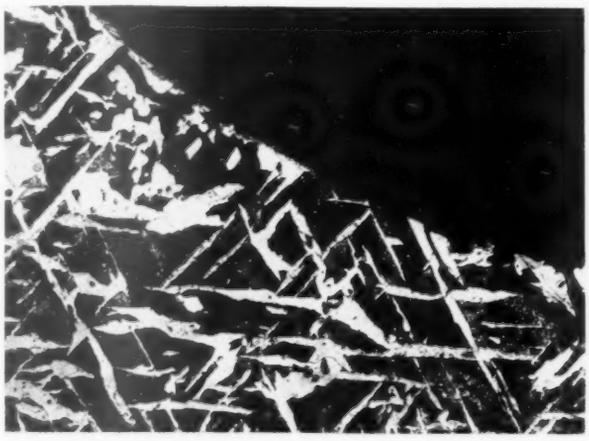

Fig. 127.—Blowhole from Mould Facing.

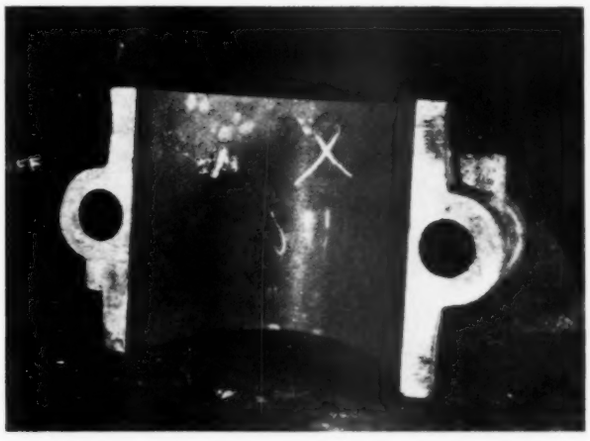

Fig. 128.—Sandy Metal another Form of Defect.

Cold Shuts

Another form of defect, viz., what is known as the "cold shut," is seen in Fig. 129, and there is not usually much difficulty in recognising this particular defect, the general form being as seen here. This defect is chiefly due to cold metal, runners into mould not being sufficiently large or not correctly placed, or excessive use of chaplets. Such a defect is usually recognisable from its appearance, but can easily be confirmed by a microscopic examination of a section. Fig. 130 shows the typical appearance of such a defect, a definite line of demarcation being present, where the streams of metal have met, associated with oxide.

Fig. 129.—Cold Shut.

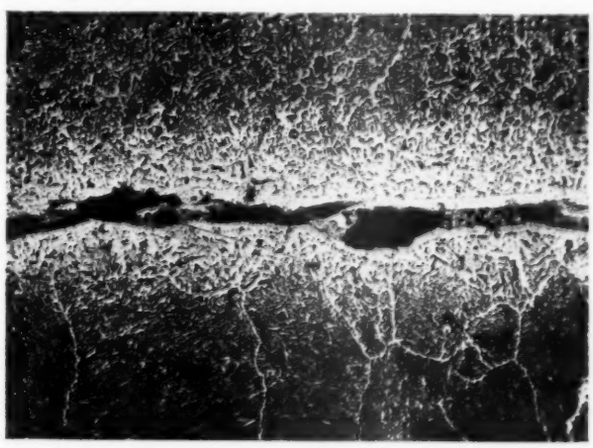

Fig. 130.—Section of Cold Shut. × 20.

Radiography

Defects such as are revealed by ordinary methods of examination are well understood, but when the modern method of X-ray examination is employed, the diagnosis of defects on the radiograph requires an expert to interpret. By such a method of examination, however, defects may be disclosed in a casting which previously appeared perfectly sound.

It is perhaps fairly safe to say, that only a small proportion of commercially-produced castings would be 100 per cent. perfect under such searching examination, but it is necessary to preserve a calm mind in the face of such results as may be obtained. Such a method of examination, however, if the results are carefully interpreted, can be of the utmost value to all, brief reference having already been made to some typical results. The technique of radiological examination of steel castings is now, thanks to scientific research, at a high level, although the correct interpretation of the negative, as mentioned previously, necessitates specialised skill and experience.

Whilst the use of X-ray and similar methods of examination may appear somewhat futuristic to some, it is being used fairly extensively in some fields, and its use can be expected to increase as its real value becomes more generally understood and appreciated.

Repairing Steel Castings

Referring now to repairs to steel castings by means of the electric-welding process, a clause is contained in some modern specifications rigidly prohibiting such, even in those instances where defects are purely superficial. The importance of such a proviso and the necessity of searching inspection before and after repair, can be appreciated, when consideration is given to the high stresses entailed in the working of modern plants.

Castings of to-day being designed to give minimum weight, little or no risk at all can be taken where repairs may affect the soundness of the casting. The methods of repairs to castings vary considerably; comprising operations by means of electric welding or acetylene welding, burning with metal, brazing, soldering plugging or patching.

In those instances of repair where it is considered local stresses may arise as a result of electric welding, or burning, a low-temperature anneal is carried out to ensure the removal of such stresses, prior to the casting being finished machined. A minor defect in a casting gives rise to lengthy discussion when a proposal to repair is put forward to determine whether the casting should be repaired or rejected. The overseer has a most responsible duty, and efficient inspection and fair decision may only be given in conjunction with a knowledge of those methods by which castings are manufactured, coupled with an understanding of the service they are to give.

Briefly, it may be said that the degree to which a casting is defective, serious or otherwise, can only be determined by those with a detailed knowledge of the methods under which it was made. It is the opinion of a large number that the process of electric welding, done with careful control is perfectly reliable, even on the body of castings for high temperature and high-pressure turbines, providing the castings are afterwards heat-treated to remove strain. The same remarks apply to the operation known as "burning" on iron castings, which is carried out by pouring molten metal into a mould made round the defective part.

In this connection a test was recently carried out by breaking a bar from a pair of test-bars, cast together, afterwards jointing the broken bar by the method described. The two bars were then machined, and on testing in the usual manner identical results were obtained, namely, 15.2 tons per sq. in. The micrograph, Fig. 131, shows the excellent nature of the junction be-

tween the parent metal and that used to create the join.

It is rather difficult to understand the hesitancy shown by some people in accepting such processes as have been mentioned in the case of minor and superficial repairs. It is the general opinion amongst those connected with the manufacture of castings, that more confidence should be displayed where defects are not unduly serious. Sound material and good design go hand in hand in any reliable structure, and the vast strides that have been made in recent years in all fields are a result of co-operation of all

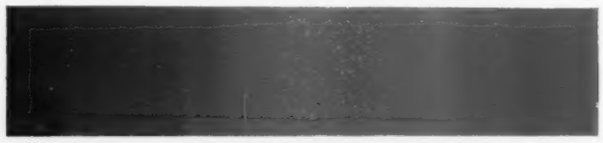

Fig. 131.—Micrograph of Burned Test-Bar.

concerned in the manufacture of a casting, viz., designer, patternmaker, moulder and metallurgist.

Conclusion

Regarding the art of moulding and coremaking and its relation to science, mechanical and metallurgical, it is true that progress has been achieved in accelerated production and in the composition of metals, which latter has greatly increased strength values. The improvement of the metallurgical side has been enormous of recent years, and, due to decreased scantlings, as a result the foundryman's problems have seriously increased.

Nevertheless, art and science in industry exist apart as well as co-ordinate, and an important factor towards the production of sound castings of intricate design is the wealth of technique acquired by craftsmen over years of experience.

It is now widely recognised that still further co-ordination is necessary, and this is reflected in some of the very able Papers recently given by members of the Institute, and also in the educational schemes which have been recently arranged for in Sheffield, and by the British Cast Iron Research Association; it is hoped these schemes will thoroughly combine the practical and scientific side and make both as one.

Both appear to be excellent schemes on paper, and it is to be hoped they are going to produce a class of executives for the profession educated on all the points that have been referred to. If so, it is considered that the foundrymen of the future are going to get a great opportunity of producing the perfect casting so much required in modern engineering, in which lightness of design, due to the great advance in materials, has become such an essential feature.

The authors desire to say again in conclusion that it has been their intention to deal with the various subjects from as practical a standpoint as possible, and venture to hope that it will be a contribution interesting to all in the foundry and to engineers, who use the products therefrom. They take this opportunity of thanking the Directors of Messrs. Vickers-Armstrongs, Limited, especially Sir Charles Craven and Mr. J. Callander, for their kind permission to use the illustrations, without which the authors would not have been able to attempt so effectively to explain the various points relating to the subject.

Mr. E. R. Lingeman, the British Commercial Secretary at Buenos Aires, is at present in this country on an official visit. Mr. Lingeman will be available at the Department of Overseas Trade on October 28 and 29 for the purpose of interviewing manufacturers and merchants interested in the export of United Kingdom goods to the Argentine. At a later date he will visit a number of industrial centres in the provinces.

The "Quick Gag" Machine

When we reviewed a leaflet describing this machine we promised to give further details later, because it represents just one more change from foundry improvisation to properly-studied equipment. The general appearance of the tool is shown in Fig. 1. For its operation the machine is firmly secured to a bench so that the handle may be pulled over freely. A measuring device supplied with the machine should be installed at right-angles to the tool, so that a rod when passed through the aperture will rest against the stop provided by the measure. Fig. 2 shows the machine used as a cropping tool, this being effected by merely pulling over smartly the long handle. Fig. 3 shows a rod in position for making the small bend of the gagger. This is effected by placing the long screw provided through the hole in the top facing, thus forming

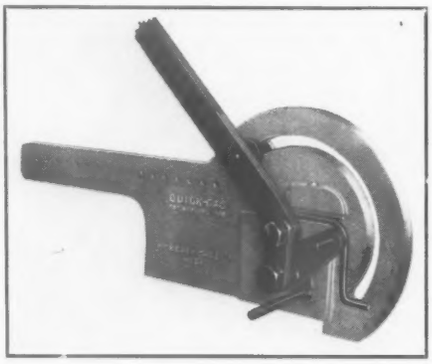

Fig. 1.—General Appearance of the Quick-Gag Machine.

a stop for the making of the short leg by again pulling over the lever.

Fig. 4 shows the rod in position for the second leg of the gagger and the position after bending. This position is the one for extracting the gagger when finished, which is effected by first exchanging the long screw for the short one to allow the rod to pass through the slot from the back. The long screw is pushed through one of the

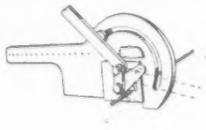

Fig. 2.

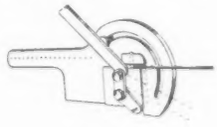

Fig. 3.

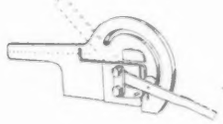

Fig. 4.

holes, set off in inches, so that it may act as a stop to determine the length of the gagger.

The production is stated to be of the order of 250 to 300 per hr., and gaggers of any length can be made from $\frac{3}{8}$-in., $\frac{1}{2}$-in. and $\frac{5}{8}$-in. rod. The machine is made by the Norbury Engineering Company, Limited, of Hyde, Cheshire, and sold by Robson Refractories, Limited, of Darlington.

The Joint Committee of Light Metal Trades Unions is approaching the National Light Castings Iron Founders' Federation for a restoration of wage cuts made in 1928.

Notes from the Branches

Birmingham Branch.—At the last meeting of the Birmingham Branch of the Institute of British Foundrymen a handsome cabinet and arm chair were presented to Mr. L. W. Bolton, who recently retired from the office of hon. secretary after five years' most efficient service. Mr. Bolton expressed his appreciation of the gifts, which he said were his own choice. A diploma granted by the General Council of the Institute was handed to Mr. W. H. Bamford for his Paper, read before the Branch, entitled "Cupola Practice and Carbon Control." Mr. Lunt said they not only congratulated Mr. Bamford upon his success, but felt that he had brought honour to the Branch.

Newcastle-upon-Tyne Branch.—During the course of his presidential address at the opening meeting of the Newcastle-upon-Tyne Branch of the Institute of British Foundrymen, Mr. J. Smith presented the prizes awarded in the "John Surtees Memorial" examination, held early in the year. The silver medal in the junior section was awarded to Mr. H. Vasey, together with textbooks of his own choice, and, in congratulating Mr. Vasey and the remaining competitors, the Branch-President expressed his appreciation of the courtesy shown by Dr. E. C. Edgar, the Principal of the Rutherford Technical College, and the hard work put in by Dr. Edgar and his assistants in coaching the foundry classes.

Publication Received

Metal Casting. Vol. 1, No. 1.—This is the title of a bulletin produced by Mr. C. D. Abell, of Horton Lane, Bradford, Yorks. The first issue is devoted to the question of sulphur control in cupola practice. The bulletin is issued free to all those interested in ironfounding.

British Foundry School

(*Concluded from page* 315.)

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Peglers, Ltd., Doncaster	2	2	0
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Vickers-Armstrongs, Ltd., Barrow-in-Furness	5	5	0
Wellman, Smith, Owen Eng. Corporation, Ltd., London	2	2	0
Mr. J. B. Williams, Bromsgrove ...	3	3	0

There is still time for prospective candidates to enter for the first year's course, and registrations for next session can be made. Candidates must have had practical experience in the industry, and must have reached a suitable stage of preliminary education, so as to ensure their being able to profit by the instruction. Further information may be obtained from the Secretary of the School, or Principal, Birmingham Central Technical College, or from the Hon. Treasurer, 21, St. Paul's Square, Birmingham, 3.

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This Week's News in Brief

Trade Talk

MESSRS. COX & DANKS, LIMITED, are opening a branch office at Lloyds Bank Chambers, Wind Street, Swansea.

ANOTHER BLAST FURNACE was put into commission at Scunthorpe by the Appleby-Frodingham Steel Company, Limited, recently.

ONE OF TWO BLAST FURNACES has been restarted at the Hatherton furnaces of Messrs. G. & R. Thomas, Limited, Bloxwich, Staffs.

MESSRS. WM. GRAY & COMPANY, LIMITED, West Hartlepool, have received an order for another 9,000-ton cargo steamer for Sir R. Ropner & Company, Limited, West Hartlepool.

TWO BRONZE CROSSES, each 11 ft. high and 6 ft. 6 in. in width, and each weighing 1 ton, have been cast and finished by the firm of Messrs. Thomas Dockrill, Sons & Company, South Great George Street, Dublin, for the new Cathedral at Mullingar.

OCTOBER 30 NEXT is the last day for receiving proofs in connection with a dividend to be paid by Mr. Edwin Mallalieu, carrying on business at Jubilee Street, Manchester, brassfounder. The trustee is Mr. L. A. West, Byrom Street, Manchester, 3.

CONTRACTS HAVE BEEN PLACED with the Whessoe Foundry & Engineering Company, Limited, Darlington, and Messrs. Grant & Livingston, Ilford, by the Shell-Mex & British Petroleum Company, Limited, for the erection of a storage tank for 1,500,000 galls. of petroleum spirit at Jarrow.

THE LATE MR. THOMAS B. MACKENZIE, M.I.Mech.E., of Colvilles, Limited, has left £15,000 to provide scholarships for science students at the Royal Technical College, Glasgow. In his bequest Mr. Mackenzie indicated his desire that preference be given to students in the employ of Messrs. Colvilles.

THE GRAHAMSTOWN IRON COMPANY, LIMITED, general ironfounders and porcelain and vitreous enamellers, of Falkirk, have opened an office and showrooms at the Bank of Scotland Buildings, George Square, Glasgow, where a representative selection of the company's grates, ranges, and other manufactures is displayed.

THE UNITED STEEL COMPANY, LIMITED, have put another furnace into commission at their Appleby-Frodingham works in Lincolnshire. The output will be increased by 1,000 tons a week. In the past half-year the works have produced more than half-a-million tons of iron and steel, and it is anticipated that the million mark will be passed by December of this year.

MESSRS. FOUNDRY ENGINEERS, LIMITED, of Halifax, inform us they are very busy at present on a number of orders for sand-preparing plant and much more extensive foundry equipment. As a remarkable example of size, a recent order may be quoted for a knock-out station a little over 100 ft. in length and 10 ft. wide, possibly a world record for that item of plant.

THE NORTH EASTERN MARINE & ENGINEERING COMPANY, LIMITED, of Wallsend-on-Tyne, are to engine two vessels, each of 8,600 tons, to be built by R. & W. Hawthorn, Leslie & Company, Limited, at Hebburn-on-Tyne, for Joseph Constantine Steamship Company. The propelling machinery will comprise triple-expansion engines working in conjunction with Hawthorn-Gotavarken turbo-compressors.

GENERAL REFRACTORIES, LIMITED, have secured a large contract for supplying Forges de Clabecq, the Continental steel producers, with the entire requirements of refractory materials for their new plant, which, of its kind, will be one of the most modern and efficient in Europe. The installation includes a strip mill, reheating furnaces and soaking pits of the most up-to-date type. This increased business coincides with recent developments at the Belgian works of General Refractories, Limited.

AT THE LAUNCH of the "Fort Amherst" from the yard of the Blythswood Shipbuilding Company, Limited, Scotstoun, it was mentioned that the Glasgow engineering firm of Messrs. David Rowan & Company, Limited, is on the eve of completing its thousandth marine engine. The propelling machinery of the "Fort Amherst" is the 982nd set completed by David Rowan & Company, Limited, and, as the firm has further contracts on hand, the thousandth mark is expected to be reached within the next few months.

THE FINAL LIST of additional subscribers to the Guarantee Fund of the Sheffield Conference of the Institute of British Foundrymen, held last July, is as follows:—Stewarts and Lloyds, Limited, £20; C. & J. Hampton, Limited, £10 10s.; Wm. Wild & Sons, £10; J. & J. Dyson, Limited, £10; A. A. Brown, £5; J. Preston, Limited, £5; Morgan Crucible Company, Limited, £5; Frodair Iron & Steel Company, Limited, £5; Turton Bros. & Matthews, Limited, £2; Mansfield Sand Company, Limited (subscription in full), £1 1s.; anonymous, £1 1s. Total, £74 12s.

NEW EQUIPMENT for the manufacture of "Adamite" steel rolls was formerly put into operation on October 18 at the Whifflet Foundry of Messrs. R. B. Tennent, Limited, Coatbridge, manufacturers of chill, grain and steel rolls, and heavy castings. Hitherto Messrs. Tennent have been mainly interested in the manufacture of rolls for the steelworks' rolling mills of this country, the Dominions, and Colonies, but early this year, while on a visit to the United States, Mr. James Tennent, managing director of the firm, obtained for the Whifflet Foundry the manufacturing rights in Great Britain of "Adamite" alloy rolls. Subsequently considerable extensions were made to the Coatbridge works, costing about £20,000, to proceed with the manufacture of these new alloy steel products. The additional plant includes new roll-turning lathes and annealing furnaces. The new alloy has been extensively developed in the United States, and it is noted for its special wear-resisting qualities.

Contracts Open

Bridlington, October 28.—Centrifugal pump and fittings with rising main, for the Town Council. The Borough Engineer, Town Hall, Bridlington.

Ely, October 26.—5,272 yds. of 2-in. and 5,633 yds. of 3-in. cast-iron pipes, together with valves, hydrants, etc., for the Town Council. Mr. A. E. King, Surveyor. (Fee £1 1s., returnable.)

Cairo, November 11.—Electrically-driven centrifugal pumping plant, etc., for the Egyptian Ministry of Public Works, Tanzim Department. The Department of Overseas Trade. (Reference T.Y. 5,385.)

Hadstock, October 28.—45 tons of 3-in dia. cast-iron pipes and specials, for the Saffron Walden Rural District Council. Messrs. Sands & Walker, Milton Chambers, Nottingham. (Fee £2 2s., returnable.)

Llanybyther, October 26.—3-in. dia. cast-iron pipes, with valves, hydrants, standpipes and fittings, for the Aberayron Rural District Council. Mr. R. Jones, engineer, Llandyssul. (Fee £2 2s., returnable.)

Wellingborough, October 28.—1,550 yds. 5-in. dia. spun-iron water mains; duplicate electrically-driven centrifugal pumps and motors; also elevated steel tank, capacity 23,000 galls., for the Raunds Urban District Council. Mr. G. Whittam, surveyor, Brook Street, Raunds, Wellingborough. (Fee £2 2s., returnable.)

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

Electric Steels, Limited, 6, Duke Street, London, W.C.2.—Capital £55,000. Directors: E. G. Batt, W. H. Clark, H. A. Greaves, and F. A. de Silva.

R. Goodwin & Son (Engineers), Limited.—Capital £15,000 in £1 shares. To take over the business of ironfounders and engineers carried on at Ivy House Foundry, Ivy House Road, Hanley, Stoke-on-Trent, as "R. Goodwin & Sons." Directors: G. Goodwin, W. L. Goodwin, F. Goodwin, J. S. Goodwin, and F. Rushton.

Weyburn Engineering Company, Limited.—Capital £120,000. To enter into agreements with the Weyburn Engineering Company, Limited (in voluntary liquidation), T. Lister, H. Gordon, and Burn Silent Gears, Limited; and to carry on the business of engineers, etc. Directors: H. Gordon, Weyburn, Elstead, Surrey; P. Richardson, P. H. Bentley, L. F. D. Watson, and M. P. Gordon.

Personal

THE DIRECTORS OF Allied Ironfounders, Limited, announce that Mr. James Shaw (managing director of Planet Foundry Company, Limited, Guide Bridge, and of British Bath Company, Limited, Greenford), has been appointed managing director.

DR. ROBERT ROBERTSON, LL.D., a former Dean of Guild of Glasgow, present chairman of Glasgow Royal Technical College, has been elected Deacon-Convener of the Trades of Glasgow. Dr. Robertson is a B.Sc. of Edinburgh University and an engineer by profession.

Obituary

MR. JAMES CUMMING, who was a partner in the firm of Rainsford & Lynes, brassfounders, Birmingham, died recently at the age of 62.

MR. JOHN BROWN, aged 35, received fatal injuries on Saturday at Kirkland Foundry, Methil, when a metal casting which he was loading on a truck fell and crushed him.

THE RIGHT HON. ARTHUR HENDERSON, P.C., M.P., died last Sunday at the age of 72. He was born in Glasgow in 1863 and served his apprenticeship as a moulder in the works of Robert Stephenson & Company, of Newcastle-upon-Tyne. He was a brilliant organiser and quickly took an interest in Trade Union matters, acquiring an ability to express his views with clarity and force through his activities as a lay preacher in the Wesleyan Methodist churches. He is probably the only practical moulder who ever achieved Cabinet rank, and he served his country with real distinction as both Home and Foreign Secretary and in many other offices. He was intensely patriotic and refused to follow some of his colleagues in the labour movement into the pacifist cause during the Great War. His greatest success, though not spectacular, was his position as labour adviser to the Government during the course of the late war. His knowledge of the trade-union mentality was unrivalled, and its rise to power after the war was unquestionably due to his organising ability. In 1926 he was made an honorary member of the Institute of British Foundrymen, an honour which he valued very highly. In recent years his main activities have been in connection with the League of Nations and disarmament. His efforts were recognised by the bestowal of the Nobel and Wateler Peace Prizes. No matter what their political party, members of the foundry industry will long be conscious of the sad and irreparable gap left in the roll of its outstanding personalities by the passing of Arthur Henderson.

Forthcoming Events

Institute of British Foundrymen

OCTOBER 25.

Lancashire Branch (Junior Section):—(1) Presidential Address; (2) Presentation of Awards; (3) "Question Time," conducted by A. L. Key, at the College of Technology, Sackville Street, Manchester, at 7.30 p.m.

OCTOBER 26.

East Midlands Branch:—"Microscopy of Cast Metals," Paper by L. E. Benson, M.Sc., at Loughborough College, Loughborough, at 6 p.m.

Wales and Monmouth Branch:—"Some Further Notes on Balancing the Elements." Paper by F. J. Cook, M.I.Mech.E., at the University College, Newport Road, Cardiff, at 6.30 p.m.

NOVEMBER 1.

Birmingham, Coventry and West Midlands Branch:—"Refractories for Foundry Use," Paper by W. J. Rees, M.Sc., at the James Watt Memorial Institute, York House, Great Charles Street, Birmingham, at 7.30 p.m.

Lincolnshire Section:—"Some Details of Modern Foundry Control," Paper by G. W. Brown, M.I.Mech.E., at the Technical College, Monks Road, Lincoln, at 7 p.m.

NOVEMBER 2.

Lancashire Branch:—"Die Castings," Paper by A. H. Mundey, at the Engineers' Club, Albert Square, Manchester, at 4 p.m.

NOVEMBER 9.

Scottish Branch:—"The Balanced-Blast Cupola," Paper by W. Y. Buchanan, at the Royal Technical College, George Street, Glasgow, at 4 p.m.

The Institute of Vitreous Enamellers

NOVEMBER 7.

Manchester:—"Notes on Furnaces for the Vitreous Enamelling Industry," Paper by Th. Teisen, C.E., at Y.M.C.A., Peter Street, Manchester, at 7.30 p.m.

XUM

THE "ROCKET" PATENT CORE MAKING MACHINE

Manufactured in 3 Standards

Sizes :—

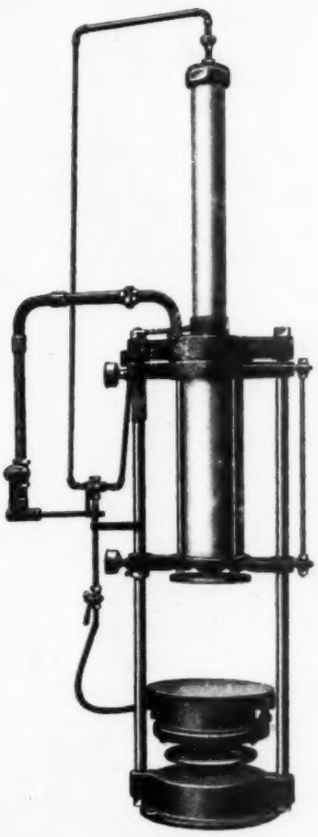
15 lb. Sand Capacity.
45 lb. Do.
100 lb. Do.

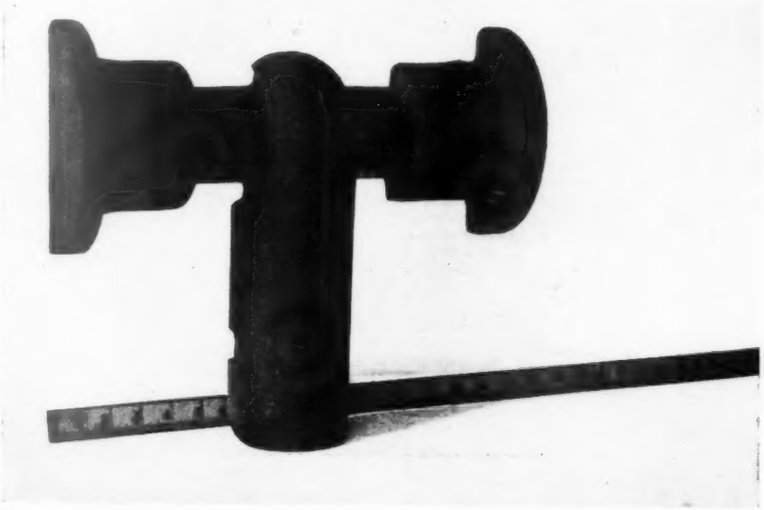
No moving mechanism in the Sand.

Repairs negligible.

Air consumption barely exceeds volume of sand used.

No foundations required.





Untouched photograph of Core produced on the machine illustrated above.

FOUNDRY ENGINEERS LTD.,

Telephone : 61459 Halifax **HALIFAX, YORKS.** Telegrams : "FEL," Halifax

Raw Material Markets

The output of steel for the month of September was the largest since October, 1929, and present conditions give reason for believing that the total output for the year will constitute a new post-war record. Buying of both iron and steel is on a large scale and, although production has been increased, there is very little iron available for sale during the remainder of this year. Some contracts have been arranged for delivery up to the close of the first half of next year. Tinplate works are well employed and, although new commitments for the shipment of tinplates abroad for the remainder of this year are having to be rejected, owing to the international agreement, the makers still have a fair amount of business in hand.

Pig-Iron

MIDDLESBROUGH.—Producers in the Cleveland area are in a very strong position and, in the majority of cases, output has been disposed of up to the end of the year. Some contracts for delivery over the first half of next year have been placed. Local steelworks are taking up basic iron as produced, and Cleveland iron is being sought after by foundrymen. Only three furnaces producing Cleveland iron are in operation, and their output barely covers the consumers' requirements. No. 3 Cleveland G.M.B. is quoted at 67s. 6d. per ton in the Middlesbrough zone, 69s. 6d. on the North-East Coast, and 67s. 3d. for delivery to Falkirk.

Heavy stocks are a thing of the past in the hematite market, and several contracts for delivery over the next six months have been arranged. Now that shipments to Italy are to be stopped, the producers of hematite will rely, more than ever, on the home market. However, the loss of the export trade will not be felt to any great extent for some considerable time. Prices are controlled by the official minimum scale, and No. 1 East-Coast hematite is quoted at 71s. per ton in the Middlesbrough zone, 72s. on Tyneside, 73s. 6d. on the rest of the North-East Coast, 74s. in Scotland, 78s. 6d. in Sheffield, and 84s. 6d. in Birmingham.

LANCASHIRE.—New business is on a fairly good scale in this district, and deliveries into consumption are steady. The light-castings trade has rather decreased requirements, but the machine-tool manufacturers and heavy electrical engineers are taking up satisfactory supplies of pig-iron. Local jobbing founders have an improved demand. In the hematite market, Lancashire consumers are taking up fairly large tonnages. Staffordshire, Derbyshire and Lancashire brands of No. 3 foundry iron are quoted at a delivered price of 74s. per ton, with Northants at 72s. 6d., Scottish No. 3 at about 81s. 6d., East Coast hematite at from 80s. 6d. to 81s., according to brand, and West Coast hematite at 81s. per ton.

MIDLANDS.—There is a satisfactory market for Midland brands of foundry iron, and deliveries from the furnaces to this area compare favourably with previous months' totals. The light-castings trade and general engineering concerns are showing increased demands, and there is every reason for expecting a further expansion in the requirements of most consumers. Prices are 67s. 6d. per ton for Northants No. 3 and 71s. for Derbyshire, Lincolnshire and North Staffordshire No. 3, including delivery to Birmingham and Black Country stations, and subject to a small rebate under certain conditions. Prices of special irons are still uncontrolled, and vary considerably. Medium-phosphorus pig-iron is available at from 72s. to 82s. 6d. per ton; low-phosphorus, including Scottish No. 3, at from 85s. to 90s.; and special refined iron at from £5 7s. 6d. to £7 per ton, delivered Midland stations. The condition of the hematite market shows little alteration, and the majority of the consumers are well covered. West Coast mixed numbers delivered Midland stations are at 84s. 6d., and for East Coast No. 3, 83s. 6d. is quoted, while Welsh mixed numbers are at 83s. 6d. per ton. For delivery into consumers' works in 10-ton lots, an additional 1s. 6d. per ton is charged.

SCOTLAND.—Local founders and steelmakers are consuming large tonnages of pig-iron. The recent improvement in shipping orders has had an encouraging effect on the market. Prices have not been altered and 70s. for No. 3 foundry f.o.t. furnaces continues to be quoted, with 2s. 6d. extra for No. 1 quality. The light-castings founders are well employed and they have covered their needs for several months ahead. No. 3 Cleveland iron is at 67s. 3d. f.o.t. Falkirk and 70s. 3d. f.o.t. Glasgow, with other English foundry irons at 1s. 3d. per ton below these figures. Basic and hematite brands of pig-iron continue to have a good demand from local steelworks. Steel-making irons are quoted at :—Mixed numbers Scottish hematite, 73s. 6d.; mixed numbers West Coast hematite, 74s.; mixed numbers East-Coast hematite, 74s.; basic, British and Indian, 70s. (less 5s. rebate), all delivered local steelworks.

Coke

Consumers of foundry coke, have, in nearly all cases, covered their requirements over the next few months. Prices are unchanged. For delivery at Birmingham and Black Country areas, best Durham coke is 36s. 6d. to 40s. per ton, and other grades are at down to 35s., while Welsh coke varies from 32s. 6d. up to 43s. 6d. Scottish low-ash coke may be obtained at around 40s.

Steel

The recent improvement in the demand for steel has been maintained and in nearly all departments active business conditions have ruled, says the official report of the London Iron and Steel Exchange. The demand for semi-finished steel appears to be taxing the productive capacity of the works, and there is a tendency for the prices of uncontrolled material to advance. In this department consumers report that it is not easy to obtain near delivery, and many of the manufacturers are only booking forward business. The market for finshed-steel materials is active and a heavy volume of business is being transacted in structural steel. The recent contracts for ships will be reflected in substantial orders for steel. Business in plates and sheets has improved considerably.

Scrap

The demand for heavy-steel scrap to feed the local steel furnaces in the Cleveland area is increasing. The current price for steel scrap is 52s. 6d. per ton delivered works, but sellers are becoming reluctant to sell at this figure. Foundry cast-iron scrap has a steady demand at 52s. 6d. and machinery cast-iron scrap broken to suitable sizes is at 54s. Clean, light, cast iron is scarce and realises prices from 43s. to 43s. 6d. The increased demand in the Midland zone has been well maintained. Prices are firm. Clean cast-iron borings are at 30s. and heavy machinery metal in handy sizes is at 55s. to 57s. 6d. Short heavy steel scrap, as used in the foundries, is at 55s. to 57s. 6d. per ton delivered works. Prices on the Scottish market continue to be firm and consumers are taking up all the material that is produced. Steelworks are now better employed and wrought-iron works also have good order-books. First-quality, heavy mild-steel melting scrap, in furnace sizes, is at 50s. per ton, and heavy basic or heavy iron and steel scrap mixed at 45s. Good wrought-iron piling scrap is at around 60s. and is firm. Good, clean, heavy, machinery cast-iron scrap, in pieces not exceeding 1 cwt., has changed hands at 57s. 6d., while ordinary cast-iron scrap, to the same specification, is 5s. less.

Metals

Copper.—Consumption is being well maintained, both in this country and in the United States. According to reports from the refineries, stocks on hand only amount to about 158,000 tons. Purchases for delivery up to the end of the year almost account for this tonnage. It is stated that there is no intention at the moment of increasing output.

Daily market prices :—

Cash.—Thursday, £34 18s. 9d. to £35; Friday, £35 5s. to £35 6s. 3d.; Monday, £34 15s. to £34 16s. 3d.; Tuesday, £34 8s. 9d. to £34 10s.; Wednesday, £34 12s. 6d. to £34 13s. 9d.

Three Months.—Thursday, £35 6s. 3d. to £35 7s. 6d.; Friday, £35 12s 6d. to £35 13s. 9d.; Monday, £35 2s. 6d. to £35 3s. 9d.; Tuesday, £34 16s. 3d. to £34 17s. 6d.; Wednesday, £35 to £35 1s. 3d.

Tin.—Buying in this country and also in the United States and on the Continent has been rather less this week, possibly due to a large degree to the political disturbances. About 200 tons of Dutch tin have arrived in this country, and reports state that further tonnages are likely to be shipped in the near future. Tinplate manufacturers in this country are well employed, and are taking up satisfactory quantities of tin. Now that the International Tin Committee has decided to increase the output by 10 per cent., further inquiries from industrial consumers are anticipated. Hitherto there has been such a pronounced shortage of spot tin that many industrial users were out of the market.

Day-to-day fluctuations :—

Cash.—Thursday, £232 to £232 5s.; Friday, £226 to £228; Monday, £220 to £225; Tuesday, £223 to £224; Wednesday, £216 10s. to £217.

Three Months.—Thursday, £221 5s. to £221 15s.; Friday, £217 15s. to £217 17s. 6d.; Monday, £217 to £217 5s.; Tuesday, £215 10s. to £216; Wednesday, £209 10s. to £209 15s.

Spelter.—New business in this metal appears to be rather scarce, although consumption is reported to have been well maintained. The zinc die casting industry is taking up a steadily increasing volume of spelter, while the galvanisers have also been rather more active recently. Brass mills are also satisfactory buyers of spelter.

Official quotations were as follow :—

Ordinary.—Thursday, £16 1s. 3d.; Friday, £16 1s. 3d.; Monday, £16 2s. 6d.; Tuesday, £16; Wednesday, £16 2s. 6d.

Lead.—There is little change to report in the condition of this market. World consumption is well maintained. Supplies of lead from Mexico are expected to be forthcoming shortly now that the labour dispute has been settled. In the American market, the majority of consumers are stated to be well covered for some considerable period, and new buying is therefore rather scarce.

Day-to-day quotations :—

Soft Foreign (Prompt).—Thursday, £18; Friday, £17 17s. 6d.; Monday, £17 16s. 3d.; Tuesday, £17 11s. 3d.; Wednesday, £17 11s. 3d.

Correspondence

[*We accept no responsibility for the statements made or the opinions expressed by our correspondents.*]

Brake Drum Design

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Again referring to "Brake Drum Design," on the subject of which you have so kindly published my letter of August 29, 1935, to clarify the production of the brake drum, we thank you for this courtesy that you have extended to us. However, in Fig. "B," showing a section of the brake drum, the different parts referred to by numerals seem to have been changed about, as the portion referred to as (1) is the steel of the drum shell; (4) is the cast-iron braking band which is the innermost part of the brake drum and is the part contacted by the brake shoes when applying the brakes. Position (2) is the migration of the carbon from the cast iron into the steel of the shell and (3) is the demarcation line between the steel and the cast iron. Will you kindly correct this, as, while it would be understood by a metallurgist without the reference numerals, the ordinary foundryman possibly would not, and there would be considerable criticism of the description.

Again thanking you, we wish to remain, yours, etc.,

CHAS. W. DAKE.

Campbell, Wyant & Cannon Foundry Company,
Muskegon, Michigan, U.S.A.

October 4, 1935.

[We very sincerely regret this mistake, which was due to a misprint.—EDITOR.]

SOURCES

CK GANISTER

FRACTORIES

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facture of Ground Ganister

NOTHING BETTER FOR THE LINING OF CUPOLAS THAN A REALLY HIGH CLASS GROUND GANISTER HAS EVER YET BEEN DISCOVERED — BUT CHEAP "PRICE CUT" RUBBISH IS DEAR AT ANY PRICE

is no Ganister like Deepcar Ganister"

→ NOT SO VERY MUCH DEARER

Railway Carriage on
hat on the best quality

→ INFINITELY CHEAPER

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eet.

RAW MATERIALS—PRICE LIST

(Wednesday, October 23, 1935)

COPPER

	£ s. d.
Standard cash	34 12 6
Three months	35 0 0
Electrolytic	39 5 0
Tough	37 0 0
Best selected	37 10 0
Sheets	68 0 0
India	49 5 0
Wire bars	39 5 0
Ingot bars	39 5 0
H.C. wire rods	43 0 0
Off. av. cash, Sept.	34 1 5⅝
Do., 3 mths., Sept.	34 9 5⅛
Do., Sttlmnt., Sept.	34 1 6½
Do., Electro, Sept.	38 4 10½
Do., B.S., Sept.	37 9 4½
Do., wire bars, Sept.	38 10 8½
Solid drawn tubes	10½d.
Brazed tubes	10½d.
Wire	6½d.

BRASS

Solid drawn tubes	9½d.
Brazed tubes	11½d.
Rods, drawn	8½d.
Rods, extd. or rlld.	5d.
Sheets to 10 w.g.	7½d.
Wire	7½d.
Rolled metal	7½d.
Yellow metal rods	5d.
Do. 4 × 4 Squares	5½d.
Do. 4 × 3 Sheets	5½d.

TIN

	£ s. d.
Standard cash	216 10 0
Three months	209 10 0
English	217 0 0
Bars	217 10 0
Straits (nom.)	217 10 0
Australian (nom.)	217 0 0
Eastern	215 0 0
Banca (nom.)	217 10 0
Off. av. cash, Sept.	224 3 3⅞
Do., 3 mths., Sept.	212 12 4½
Do., Sttlmt., Sept.	224 2 7⅞

SPELTER

	£ s. d.
Ordinary	16 2 6
Remelted	15 5 0
Hard	13 2 6
Electro 99.9	18 15 0
English	17 2 6
India	14 2 6
Zinc dust	19 10 0
Zinc ashes	4 10 0
Off. aver., Sept.	15 10 3½
Aver. spot, Sept.	15 8 3⅞

LEAD

	£ s. d.
Soft foreign ppt.	17 11 3
Empire (nom.)	18 6 3
English	19 10 0
Off. average, Sept.	16 5 9⅓
Average spot, Sept.	16 5 2⅞

ALUMINIUM

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	25 0 0
Do., V.M. ex-whse.	26 5 0
Rods	29 5 0

ANTIMONY

	£ s. d. to £ s. d.
English	83 0 0 to 84 0 0
Chinese, ex-whse.	74 0 0
Crude, c.i.f.	38 0 0

QUICKSILVER

	£ s. d. to £ s. d.
Quicksilver	11 12 6 to 12 0 0

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—	
25%	8 17 6
45/50%	12 15 0
75%	17 17 6
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free	4/6 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£18 0 0 to £20 0 0
Ferro-tungsten—	
80/85%	3/- lb.
Tungsten metal powder—	
98/99%	3/3 lb.
Ferro-chrome—	
2/4% car.	33 0 0
4/6% car.	21 15 0
6/8% car.	21 0 0
8/10% car.	21 0 0
Ferro-chrome—	
Max. 2% car.	34 0 0
Max. 1% car.	36 5 0
Max. 0.70% car.	37 5 0
70% carbon-free	9½d. lb.
Nickel—99.5/100%	£200 to £205
"F" nickel shot	£184 0 0
Ferro-cobalt, 98/99%	5/6 lb.
Metallic chromium—	
96/98%	2/5 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to 11 5 0
76/80% packed	£11 15 0 to 12 5 0
76/80% export	(nom.) £9 15 0
Metallic manganese—	
94/96% carbon-free	1/3 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 7/32 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in.	3d. lb.
Do., under ¼ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

	£ s. d.	£ s. d.
South Wales—		
Heavy steel	2 17 6	to 3 0 0
Mixed iron and steel	2 12 0	to 2 15 0
Heavy cast iron		2 15 0
Good machinery		2 17 6
Cleveland—		
Heavy steel		2 12 6
Steel turnings		1 17 6
Cast-iron borings		1 7 6
Heavy cast iron		2 12 6
Heavy machinery		2 14 0
Midlands—		
Light cast-iron scrap		2 7 6
Heavy wrought iron	2 17 6	to 3 0 0
Steel turnings		1 15 6
Scotland—		
Heavy steel		2 10 0
Ordinary cast iron		2 12 6
Engineers' turnings		1 19 6
Cast-iron borings	1 17 6	to 1 18 9
Wrot-iron piling		3 0 0
Heavy machinery		2 16 0

London—Merchants' buying prices, delivered yard.

Copper (clean)	31 0 0
Brass	20 0 0
Lead (less usual draft)	17 0 0
Tea lead	13 0 0
Zinc	10 0 0
New aluminium cuttings	70 0 0
Braziery copper	28 0 0
Gunmetal	28 0 0
Hollow pewter	155 0 0
Shaped black pewter	125 0 0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	70/-
Foundry No. 3	67/6
,, at Falkirk	67/3
,, at Glasgow	70/3
Foundry No. 4	66/6
Forge No. 4	66/6
Hematite No. 1	71/-
Hematite M/Nos.	70/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	74/-
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	67/-
,, No. 3 fdry.	71/-
Northants forge	63/6
,, fdry. No. 3	67/6
,, fdry. No. 1	70/6
Derbyshire forge	67/-
,, fdry. No. 3	71/-
,, fdry. No. 1	74/-
Scotland—	
Foundry No. 1, f.o.t.	72/6
,, No. 3, f.o.t.	70/-
Hem. M/Nos. d/d	73/6
Sheffield (d/d district)—	
Derby forge	64/6
,, fdry. No. 3	68/6
Lincs forge	64/6
,, fdry. No. 3	68/6
W.C. hematite	86/-
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	74/-
Staffs fdry. No. 3	74/-
Northants fdry. No. 3	72/6
Cleveland fdry. No. 3	74/-
Dalzell. No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	81/6
Clyde, No. 3	81/6
Monkland, No. 3	81/6
Summerlee, No. 3	81/6
Eglinton, No. 3	81/6
Gartsherrie, No. 3	81/6
Shotts, No. 3	81/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£ s. d.	£ s. d.
Bars (cr.)	9 12 6	to 9 15 0
Nut and bolt iron	7 10 0	to 8 0 0
Hoops	10 10 0	and up.
Marked bars (Staffs) f.o.t.	12 0 0	
Gas strip	10 10 0	and up.
Bolts and nuts, ¾ in. × 4 in.	15 0 0	and up.

Steel—	£ s. d.	£ s. d.
Plates, ship, etc.	8 15 0	to 8 17 6
Boiler plts.	9 5 0	to 9 7 6
Chequer plts.	10 7 6	
Angles	8 7 6	
Tees	9 7 6	
Joists	8 15 0	
Rounds and squares, 3 in. to 5½ in.	9 7 6	
Rounds under 3 in. to ¼ in. (Untested)	8 12 0	
Flats—8 in. wide and over	8 12 6	
,, under 8 in. and over 5 in.	8 17 6	
Rails, heavy	8 5 0	to 8 10 0
Fishplates	12 5 0	to 12 10 0
Hoops (Staffs)	9 7 0	
Black sheets, 24g. (4-t. lots)	11 5 0	
Galv. cor. shts. (,,)	13 5 0	
Galv. flat shts. (,,)	13 15 0	
Galv. fencing wire, 8g. plain	14 10 0	
Billets, soft	5 10 0	and up.
Billets, hard	6 17 6	to 7 2 6
Sheet bars	5 5 0	to 5 10 0
Tin bars	5 5 0	to 5 10 0

PHOSPHOR BRONZE

	Per lb. basis.
Strip	10½d.
Sheet to 10 w.g.	11½d.
Wire	12½d.
Rods	11½d.
Tubes	14d.
Castings	12½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.31
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic, Valley	18.00
Malleable, Valley	18.50
Grey forge, Valley	18.00
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.37½
Billets	27.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.90
Steel bars	1.85
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.70
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.40
Plain wire	2.30
Barbed wire, galv.	2.80
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/- to 30/-
,, furnace	19/- to 20/-
Durham foundry	20/- to 21/-
,, furnace	16/6 to 17/9
Scotland, foundry	28/-
,, furnace	25/-

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	18/9 and up.
,,	28×20 ,,	37/6 and up.
,,	20×10 ,,	26/- to 26/3
,,	18¾×14 ,,	18/9 to 19/-
C.W.	20×14 ,,	15/6 and up.
,,	28×20 ,,	32/6 and up.
,,	20×10 ,,	23/-
,,	18¾×14 ,,	15/7½

SWEDISH CHARCOAL IRON & STEEL

	£ s. d.	£ s. d.
Pig-iron	£6 0 0	to £7 0 0
Bars-hammered, basis	£16 0 0	to £16 10 0
Bars and nail-rods, rolled, basis	£15 15 0	to £16 0 0
Blooms	£10 0 0	to £12 0 0
Keg steel	£30 0 0	to £31 0 0
Faggot steel	£18 0 0	to £23 0 0
Bars and rods dead soft, st'l	£10 0 0	to £12 0 0

All per English ton, f.o.b. Gothenburg
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

	£	s.	d.		
Oct. 17 ..	34	18	9	inc.	1/3
„ 18 ..	35	5	0	„	6/3
„ 21 ..	34	15	0	dec.	10/–
„ 22 ..	34	8	9	„	6/3
„ 23 ..	34	12	6	inc.	3/9

Electrolytic Copper

	£	s.	d.		
Oct. 17 ..	39	0	0	No	change
„ 18 ..	39	10	0	inc.	10/–
„ 21 ..	39	5	0	dec.	5/–
„ 22 ..	38	10	0	„	15/–
„ 23 ..	39	5	0	inc.	15/–

Standard Tin (cash)

	£	s.	d.		
Oct. 17 ..	232	0	0	inc.	80/–
„ 18 ..	226	0	0	dec.	120/–
„ 21 ..	220	0	0	„	120/–
„ 22 ..	223	0	0	inc.	60/–
„ 23 ..	216	10	0	dec.	130/–

Tin (English ingots)

	£	s.	d.		
Oct. 17 ..	232	10	0	inc.	80/–
„ 18 ..	227	10	0	dec.	100/–
„ 21 ..	222	10	0	„	100/–
„ 22 ..	223	10	0	inc.	20/–
„ 23 ..	217	0	0	dec.	130/–

Spelter (ordinary)

	£	s.	d.		
Oct. 17 ..	16	1	3	dec.	1/3
„ 18 ..	16	1	3	No	change
„ 21 ..	16	2	6	inc.	1/3
„ 22 ..	16	0	0	dec.	2/6
„ 23 ..	16	2	6	inc.	2/6

Spelter (Electro, 99.9 per cent.)

	£	s.	d.		
Oct. 17 ..	18	15	0	dec.	1/3
„ 18 ..	18	15	0	No	change
„ 21 ..	18	15	0	„	„
„ 22 ..	18	12	6	dec.	2/6
„ 23 ..	18	15	0	inc.	2/6

Zinc Sheets (English)

	£	s.	d.		
Oct. 17 ..	25	0	0	dec.	5/–
„ 18 ..	25	0	0	No	change
„ 21 ..	25	0	0	„	„
„ 22 ..	25	0	0	„	„
„ 23 ..	25	0	0	„	„

Lead (English)

	£	s.	d.		
Oct. 17 ..	20	0	0	dec.	5/–
„ 18 ..	20	0	0	No	change
„ 21 ..	20	0	0	„	„
„ 22 ..	19	10	0	dec.	10/–
„ 23 ..	19	10	0	No	change

Imports and Exports of Pig-Iron, Iron and Steel Castings, etc., in September and the nine months, 1935, compared with a year ago.

	September.		Nine months.		September.		Nine months.	
	1934.	1935.	1934.	1935.	1934.	1935.	1934.	1935.
	Tons.	Tons.	Tons.	Tons.	£	£	£	£
Imports.								
Pig-iron—from British India	8,007	3,851	76,434	54,003	22,972	11,669	213,816	160,631
„ Foreign Countries	1,351	1,486	11,112	10,985	8,253	8,714	63,623	64,616
Total	9,358	5,337	87,546	64,988	31,225	20,383	277,439	225,247
Castings and forgings	288	238	3,012	2,298	6,132	7,038	75,151	60,019
Cast pipes and fittings	42	124	806	1,203	2,462	4,291	44,562	30,501
Stoves, grates, etc.	82	66	852	910	7,117	4,773	69,936	75,136
Baths	737	536	5,957	5,265	18,371	14,180	147,573	139,777
Hollow-ware, all kinds	159	218	1,778	1,907	8,914	14,117	101,789	126,918
Exports.								
Pig-iron, forge	181	128	910	1,154	791	546	3,815	5,227
„ foundry	4,583	7,702	53,075	69,584	17,336	26,734	181,022	241,324
„ acid	2,980	3,517	32,950	36,961	9,332	11,197	104,151	119,545
„ basic	—	588	832	819	—	1,887	2,725	2,614
Total	7,744	11,935	87,767	108,518	27,459	40,364	291,713	368,710
Castings and forgings	400	428	3,861	3,339	17,986	20,922	149,904	128,490
Cast pipes and fittings, up to 6 in. diameter	4,217	5,418	45,287	43,674	50,161	62,253	502,362	484,938
„ „ „ over 6 in.	1,336	2,488	26,668	25,975	11,625	21,390	197,944	205,035
Stoves, grates, etc.	647	684	6,361	6,302	37,557	36,677	304,321	318,540
Sanitary cisterns	225	258	2,190	2,293	6,532	7,626	64,302	67,127
Bedsteads, inc. tubes therefor	314	416	3,829	3,218	11,118	15,068	126,335	119,085
Cast hollow-ware	401	401	2,692	2,943	14,565	15,005	102,251	111,961

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(1) Practical foremen able to equip and run a modern Steel-Grit plant.

(2) Firm able to supply reliable machinery for the manufacture of Steel Grit.

(3) Foundries desirous to buy outside the "Ring."

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ASSISTANT Foreman Steel Moulder required for large European foundry in India. A man not over 35 who has held similar position or that of leading moulder and has had wide experience with jobbing steel castings up to 5 tons weight in green, dry and loam preferred. Similar experience with iron an advantage. Five-year agreement with provident fund, free medical attention and free passages out and home. Salary according to qualifications. Generous leave with free passages if re-engaged. Apply by letter stating age, and whether married or single, and enclosing copies of testimonials to "STRICKLE," c/o W. ABBOTT, LTD., 32, Eastcheap, London, E.C.3.

WANTED. — Experienced Moulder, acquainted with aluminium foundry practice, for the production of automobile castings. Able to organise foundry, make own metal patterns. Payment on production basis. Splendid opportunity for capable man. State full experience and position occupied, together with wages expected.—Box 426, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

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EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of THE FOUNDRY TRADE JOURNAL.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

FOUNDRY MANAGER requires similar position or as equipment representative. Special knowledge high-duty irons and cupola practice. Extensive experience repetition work, including machine moulding, also general engineering. (267)

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PUTNEY Foundry to let on lease; 3,500 sq. ft. approx.; three fires; partly equipped; all services. Rent £160 per annum, exclusive. Would consider for any other suitable business.—OWNER, 31, Kingston Road, Leatherhead. Tel. : 312.

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FOR SALE.—Pneulec Royer No. 1 Sand Thrower. Vertical-spindle Electric Sand Riddle, 50 cycles. Two Herbert Disintegrators. Practically new Borrman Core-blowing Machine. —S. C. BILSBY, Crosswells Road, Langley, near Birmingham.

WANTED.—Farwell-type Squeezers; also Britannia Head Ram and Adaptable Moulding Machine.—S. C. BILSBY, Crosswells Road, Langley, near Birmingham.

MACHINERY—*Continued*

CUPOLA, 3 ft. dia., by Constructional Eng. Co., Ltd.; latest type, complete with staging, blower, and all accessories; supplied new last year and guaranteed equal to new; cheap to save removal; lying Birmingham.—A. HAMMOND, 14, Australia Road, Slough.

BORRMAN Coreblowing Machine, new last year, guaranteed perfect and equal to new; cheap.—A. HAMMOND, 14, Australia Road, Slough.

FOR SALE.—Cupola, 10 ft. by 2½ ft., with 6-ft. chimney and No. 2 Sturtevant Blower, 5-in. outlet.—WOODHOUSE & MITCHELL, LTD., Brighouse.

SAND PLANT.

PNEULEC motor-driven portable Disintegrator, £24.

PNEULEC Oil-sand Mixer (new), £22.

No. 1 Simpson Mixer by August, £36.

Borrman Coreblower by August, £160.

MACNAB Sand-preparing Plant complete; as new; cheap to save removal.

PNEULEC Rotary Sand Dryer, 20 ft. long, 4-ft. Evans Sandmill, self-discharging, £21.

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NEW Dwarf Cupola, to melt 10 to 15 cwts. per hr. New Worm-geared Ladles, 5 tons, 25 cwts., 15 cwts. and 10 cwts. capacity. Ungeared Ladles, 15 cwts. and 10 cwts. capacity. Improved Cupola Spark Arresters.—T. DAVIES & SON, West Gorton, Manchester.

TILGHMAN Sand-blast Cabinet Plant, also Tilghman Sand-blast Barrel Plant for sale; cheap to save removal; lying Birmingham.—A. HAMMOND, 14, Australia Road, Slough.

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Room Plants, sizes 12 ft. x 12 ft., 12 ft. x 9 ft. and 6 ft. x 6 ft., made up in cast-iron sections.

Barrel Plants, 30 in. dia. x 36 in. long and 30 in. dia. x 18 in. long rotary barrels.

Cabinet Plants, in sizes 4 ft. x 4 ft. x 4 ft., 36-in. dia. and 30-in. dia. operators' cabinets.

Most of the above by Tilghman and complete with Air Compressors.

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Floor-type Hollow RIVETING MACHINES; cap. $\frac{3}{32}$″ dia. rivets; arranged for motor drive; ¼ h.p. required.

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WEIGHING MACHINE, 55 cwts. capacity, for 24-in. rail gauge, by Avery, in perfect order; lying at Birmingham; cheap to save removal.—A. HAMMOND, 14, Australia Road, Slough.

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Herbert Whizzer, large size. **£48.**
Brealey Disintegrator, NEW. **£26.**
Pneumatic Riddles, Jackman type. **£9 each.**

SANDBLAST PLANT

BARREL PLANT by Tilghman, *as new*, 60″×40″. Price **£240.**

NEW 8′×8′ ROOM PLANT, complete. Price **£230.**

CAST IRON ROOM PLANT, 12′×9′, complete with 400 cu. ft. motor-driven compressor for A.C. current, in new condition. Cheap.

Several small complete barrel plants in stock.

Genuine Stevenson 30-ton Crane Ladle, NEW. Price **£75.**

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